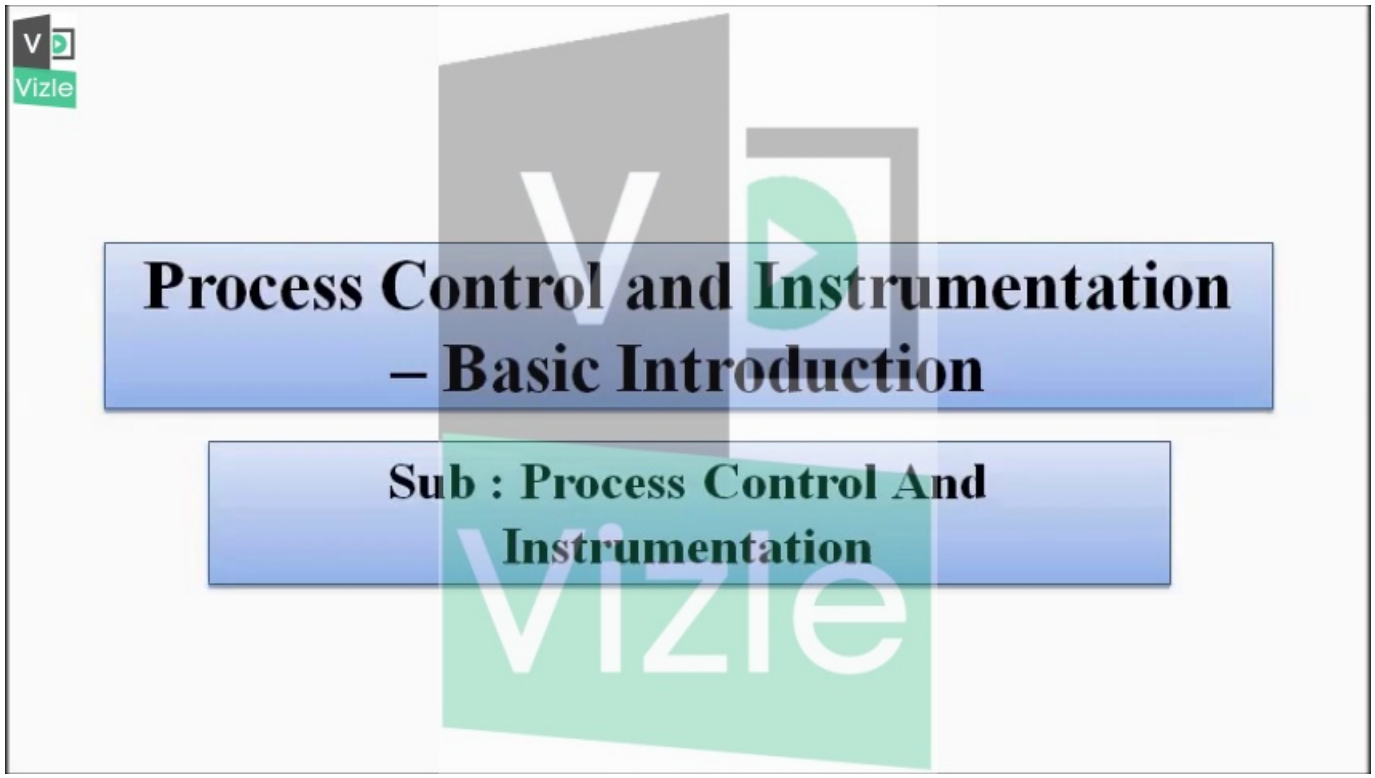


hello friends welcome to engineering tutorial

so today we are going to start a new topic a new subject

which is related to electrical electronics

and instrentation engineering basically the instrentation

engineering so the subject is process control

and instrentation so this is the basic introductory video where we

will discuss the basic concepts and then we will

move on with the the in-depth analysis of each of those

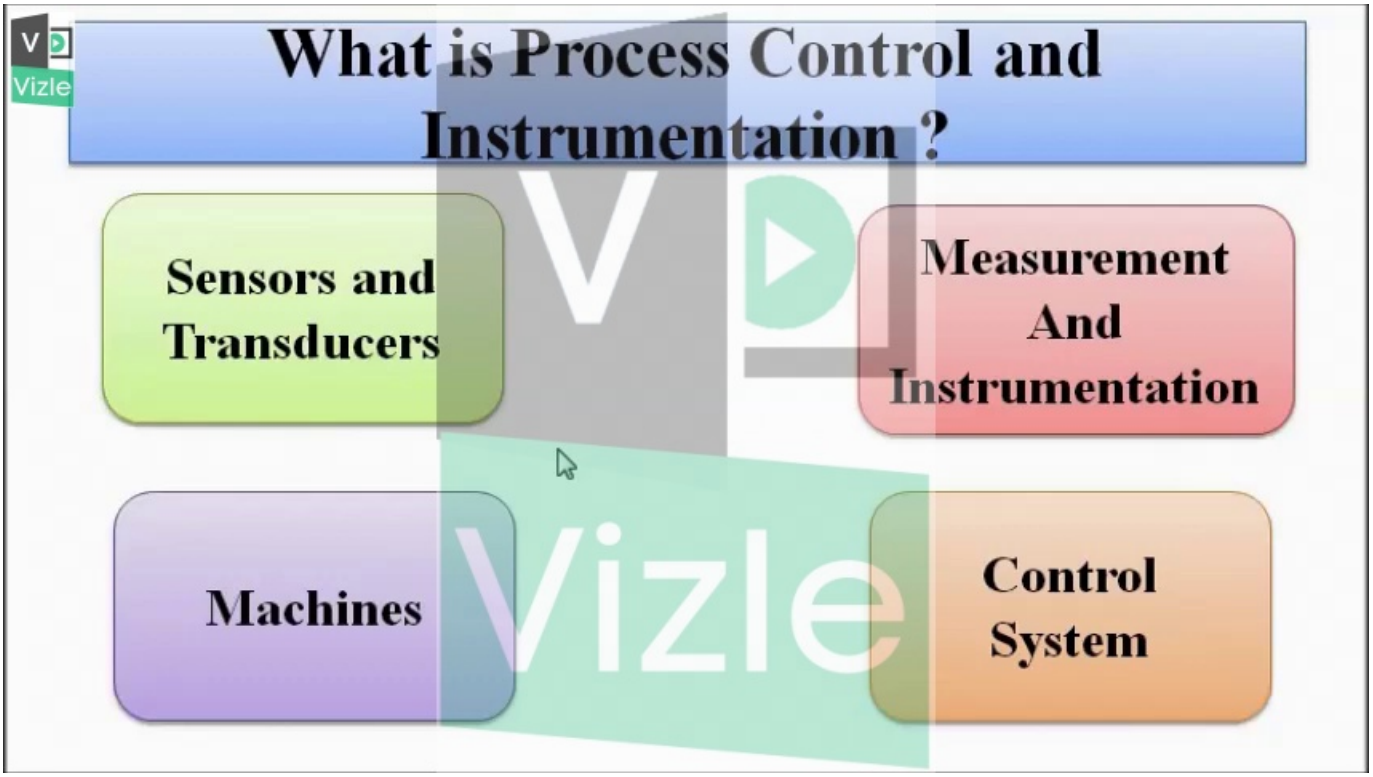
concepts which we are going to cover so the first important

thing is to understand what this subject is all about what are we going to study

in a short way

so process control and instrentation it is the you can say the

combination of four different fields of



electrical and instrentation engineering also electronics

electrical electronics and instrentation engineering

so those four fields are first sensors and transducers

measurement and instrentation the electrical and electronics measurement

and instrentation that electrical machines in general machines

not only electrical other mechanisms are also used such as

hydraulic pneatic so all of those come into play

not just electrical in general machines so

a little bit of mechanical engineering will also come into play

basic some concepts will come into play and then control system

so these four fields combined together form this okay

so it is the grouping amalgamation of these four

fields and these four form the important blocks building blocks of

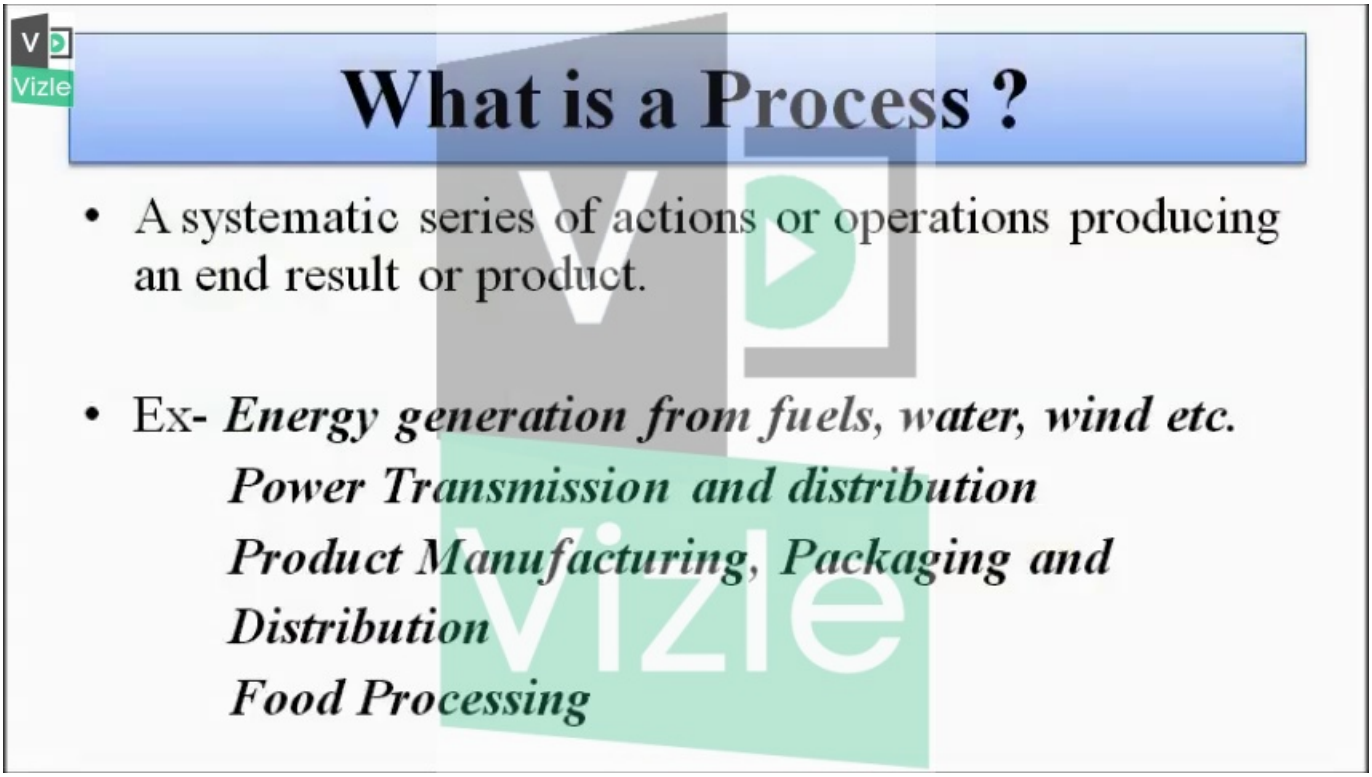
process control and instrentation so how these different fields come into

play we will discuss okay so

process control and instrentation so the name itself it represents

what is involved here process control instrentation so first let us discuss

what is a



process so basically it is a systematic series of

actions or operations which gives us an end product

an end result okay so a nber of operations

performed either simultaneously or one after the another in any way

which takes some input or many inputs and give us one or more products

result so that constitutes a process various basic examples of process we can

take first energy generation from fuels the power plants be it

thermal power plants or hydro electric power plants

or in the nuclear power plants the energy generation that

is an example of a process and it has a lot of you know

sub processes involved in it which gives us this

final result which is energy input is fuels output is energy

then power transmission and distribution the energy

which is produced the transmission of that

the distribution of that power the that is also an example of

a process the electricity that we get in our houses

so that is the end result and the energy which is generated

the transmitting of that so the energy is the input the power generated is the

input and the electricity that we get in our

homes that is the end result then various manufacturing of products

be it our mobile phones smartphones or be it anything manufacturing of any

product any electrical or electronic gadget or

simple any gadget starting from a match stick toothpicks

or chairs whatever so manufacturing of that from the raw

materials to get the end product that is a process the packaging and

distribution also come into play there so that also constitutes the individual

processes then food processing the food processing

industry you know a lot of processed foods we get

starting from chips or any burgers pizzas whatever the

mechanized ones okay which are not done by

the han beings directly but with the help of

machines so a lot of mechanized food processing

industries are there which produce various

processed foods so the raw materials form the input and the final output

which is the packaged food or drink whatever the beverage

juices or anything that is the end result

so these are some of the basic examples of process

now the main ah objective of process control what

why do we need this so the main objective of process control

and instrentation is to ensure that we get the output as

we desire the way we want it to be okay to ensure that that we get the

output the way we want to be that is the

purpose that is the job of the process control and instrentation

system suppose we are giving some input let us say 2

just for a simple example we are giving input 2

and we want an output 20. so so to design such a system

so that we get an output close to 20 that is the job of the process control u

you we will never get an output equal almost equal to 20

we will get somewhere closer to that it can be

18 it can be 19 it can be 19.5 it can be 19.8

it can be 21 it can be 22 so we may not get the exact output but in

real processes in real life process control systems we never get

the exact output there will always be some error

so it is the job of the process control and instrentation system

to minimize that error okay to keep it as

low as possible the output which we are getting should not deviate

from the desired output by a long margin to minimize the error to keep the

actual output as much as close to the desired output

that is the job of the process control system so you get the whole picture

why do we need a process control system to get

an output close as much as possible to the output which we want the actual

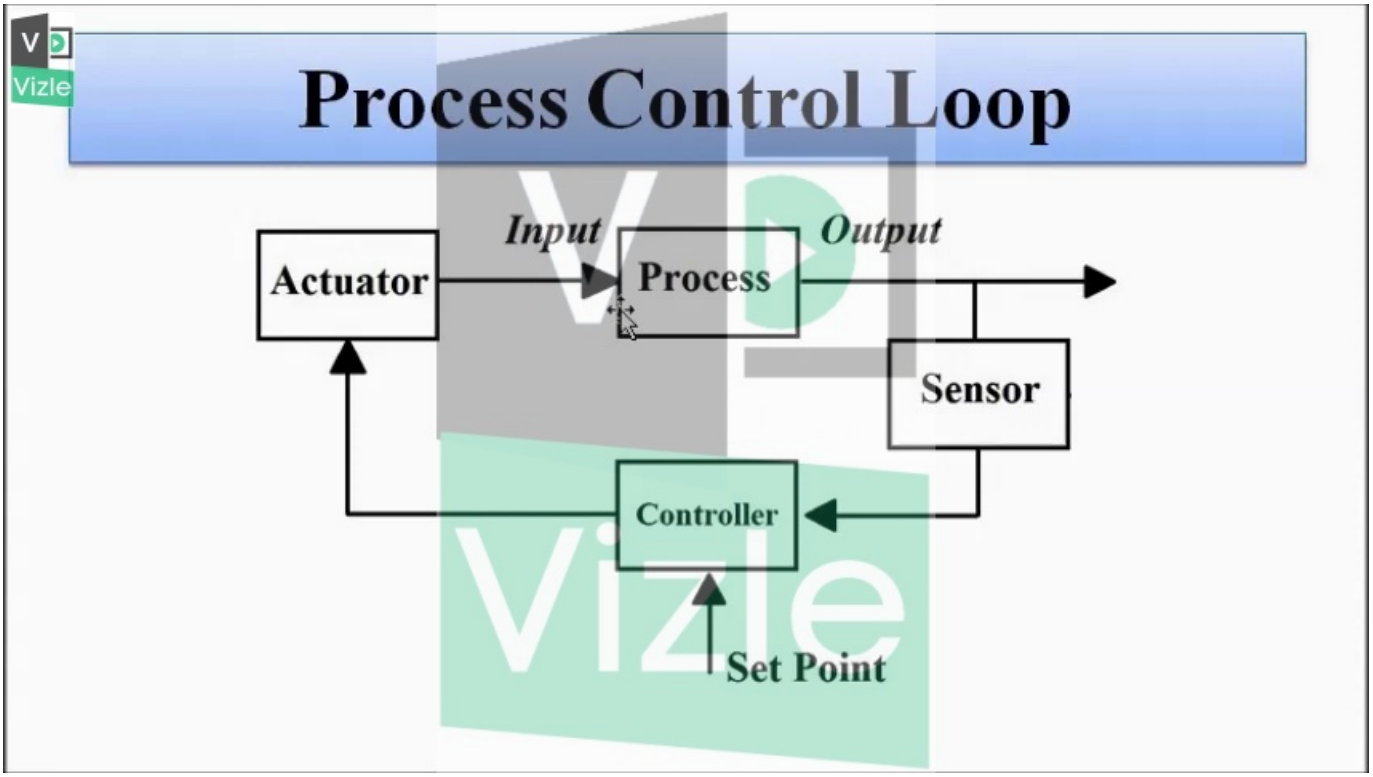
output should be close to the desired output

okay so then is the process

control loop so here all these blocks the building

blocks of process control and instrentation get

involved okay let us see how so this is the block the process block



here we give an input and we get the output

in the old days where there were no sensors

controllers or actuators whatever it was simple as that this block was

only involved input we get we give the input we get

the output the output may not be close to the output which we

want but that's the way it was because there were no sensors controllers

actuators whatever okay now with the

coming of new technologies new sensors microcontrollers

different types of actuating mechanisms the concept of process control loop came

into play now in order to maintain the quality of

the product different industries they employ process

control systems to ensure that their product always has

the same quality every time

so suppose we are giving the input to the process this block it can be

anything it can be a simple chemical reaction

a chemical plant or any manufacturing plant or energy generation plant

whatever and we are getting an output okay

so we gave the input to the process block and we are getting the output

now this output which this block produces the process output it is

measured by a sensor okay

so that sensor it senses the output it measures the output and gives it to a

controller block basically a microcontroller is used in

to nowadays this controller is given with a parameter called as set

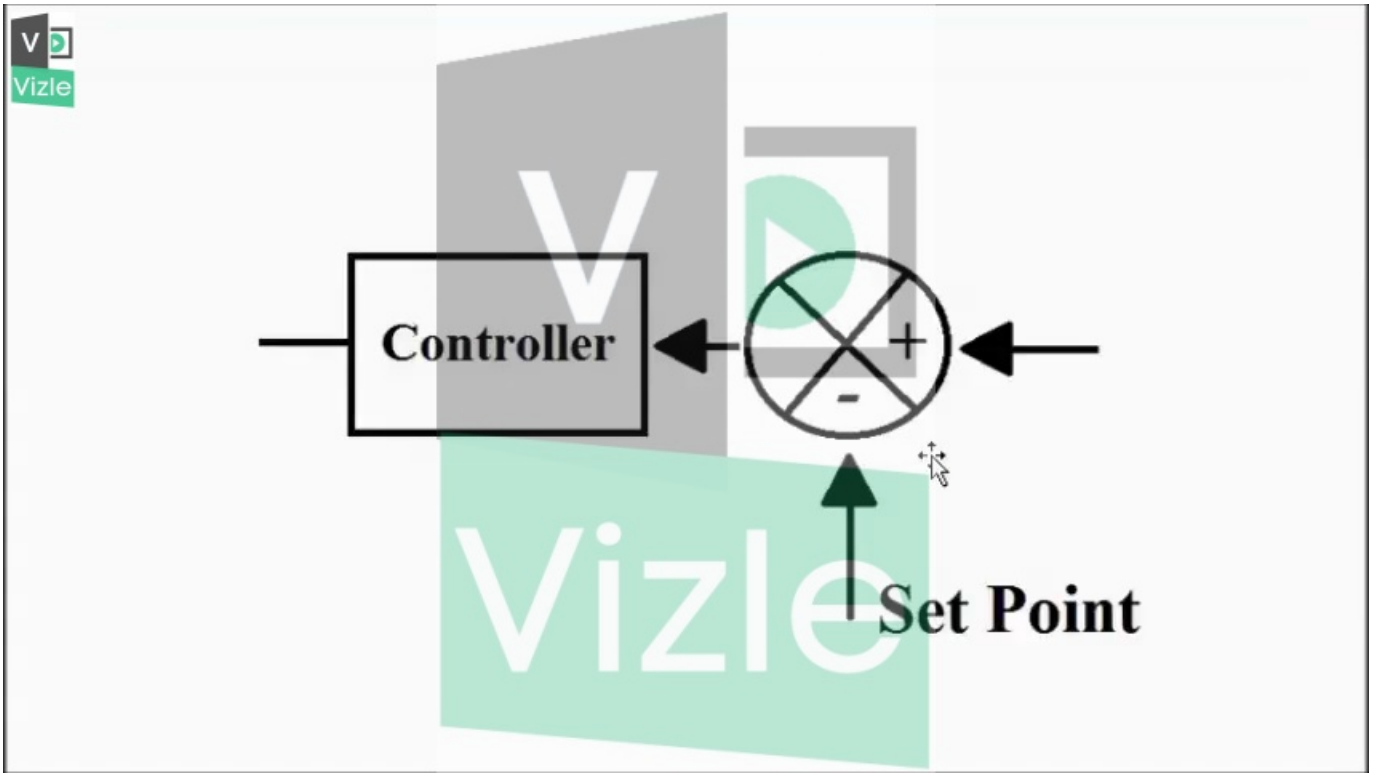
point now set point is the output which we

want okay set point is the output which we want

this output is the actual one so the controller compares the set point

or the output which we want with the actual output and calculates

the deviation okay the actual controller block looks



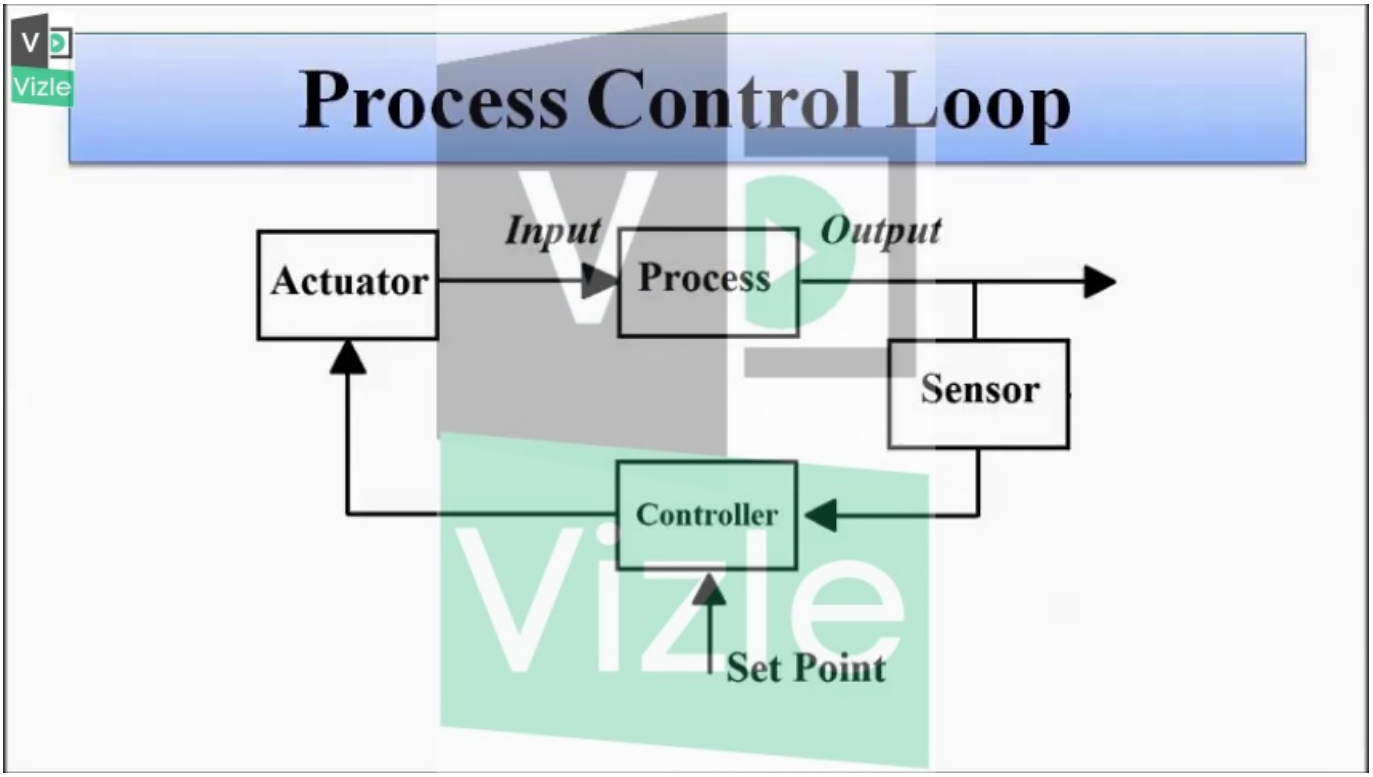
something like this this is the actual output this is the

set point so the this block

it is also called as smer block and control systems it

determines the difference which is called as the error signal

that error signal is fed to the controller



and depending on the nature of error the magnitude of the error the

controller gives a signal to the actuator

to adjust the input value okay to adjust the input value so that

the actual output comes close to the

output which we want that is the set point value

this is a simple explanation of a process control loop now each of

these blocks is a vast field in itself actuators

process sensor controller these are you know they're the

they are a basic you know this subject in itself themselves microprocessor

microcontroller sensors and transducers then actuators which electrical machines

or basic machines come into play so

this is a you know explanation of the process control loop in short

now we all know that we have discussed about sensors transducers

and also about electrical machines there are different playlists

you can watch them but here we will just discuss them in short okay

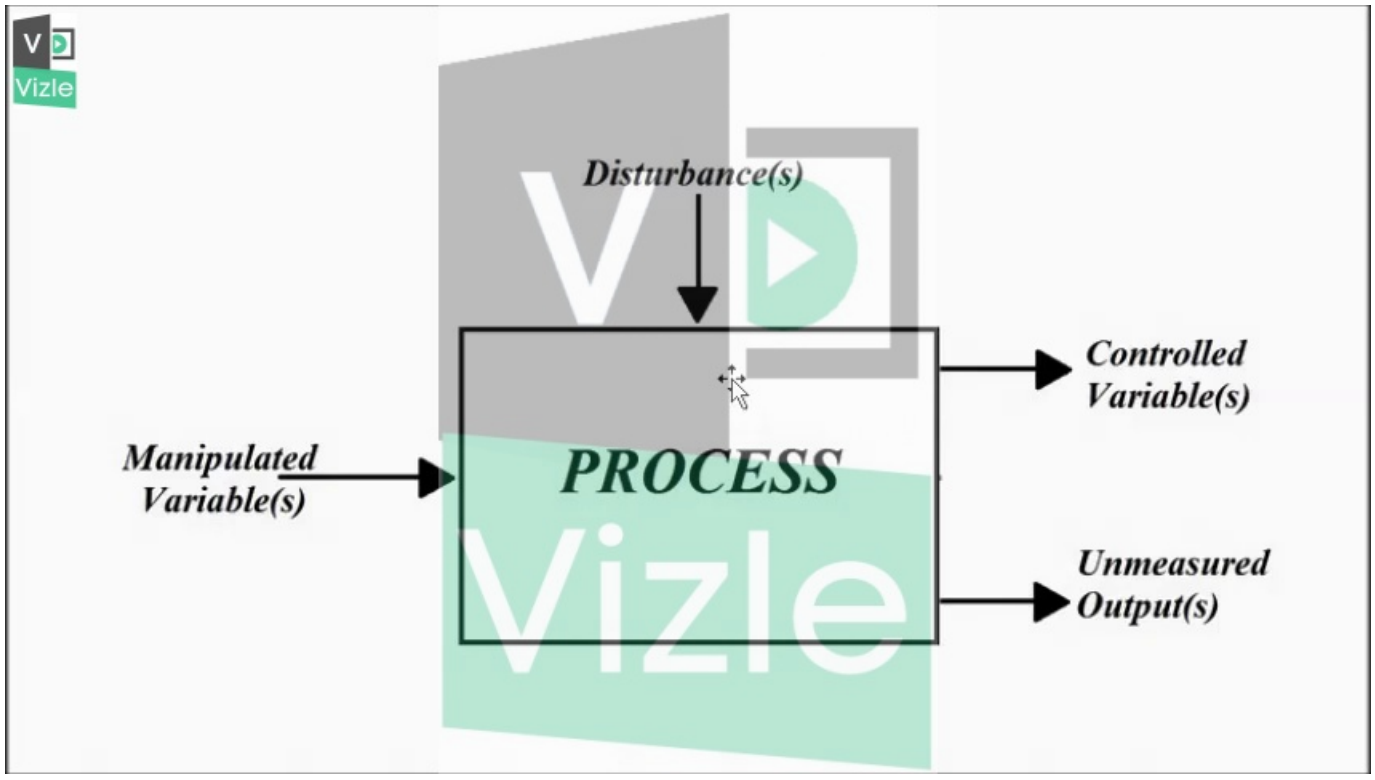
what do they do here from the point of view of process control

instrentation so before that we must understand what a process

basically looks like in a process this whole block be it

anything starting from you know processed food

manufacturing or manufacturing of any electronic gadget



or anything the input which is used to

get the output which we want which is a varied or which is adjusted

that is called as the manipulated variable

okay it is the input which is used to get the output which we want or which

directly influences or controls the output that is called as the manipulated

variable then the unnecessary inputs which

in you know indirectly become a part of the process

okay cause any fluctuations in the output these are the unnecessary inputs

those are called as disturbances we will discuss them with the help of

examples now i am not going into examples otherwise

it will create some confusion now just understand what i am saying in terms of

basic definition controlled variable is the output which

we want okay the parameter which we want to

control that is the control variable and also

sometimes in a process we get various other by-products of the process which

we don't want or we may use it for some other purpose but it is

not directly related to the process it is a

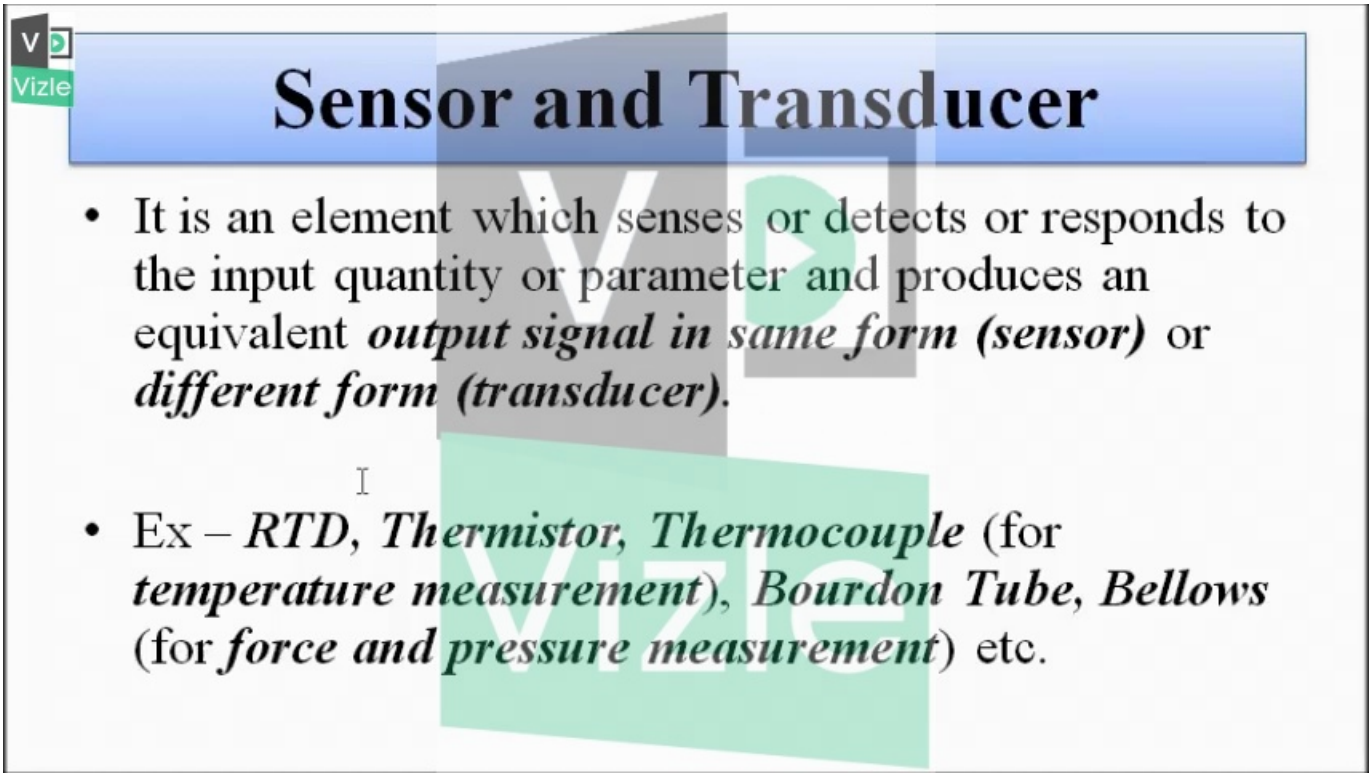
by-product of the process that is the unmeasured output

okay so these are the various things involved in the process

now let us discuss each of these individual blocks

in short first sensor and transducer i've already discussed it

many times in biomedical and sensors



transducers so it is an element which senses or

detects or any change in the input parameter or

quantity for which we have installed it to

measure it and produces an output signal in the

same form or in a different form when it is gives

us an output in the same form it is called as a sensor

and when generally it gives us an output in electrical form or a different form

that is called as a transducer so you can watch the sensors and transducers

playlist there i have discussed these things in

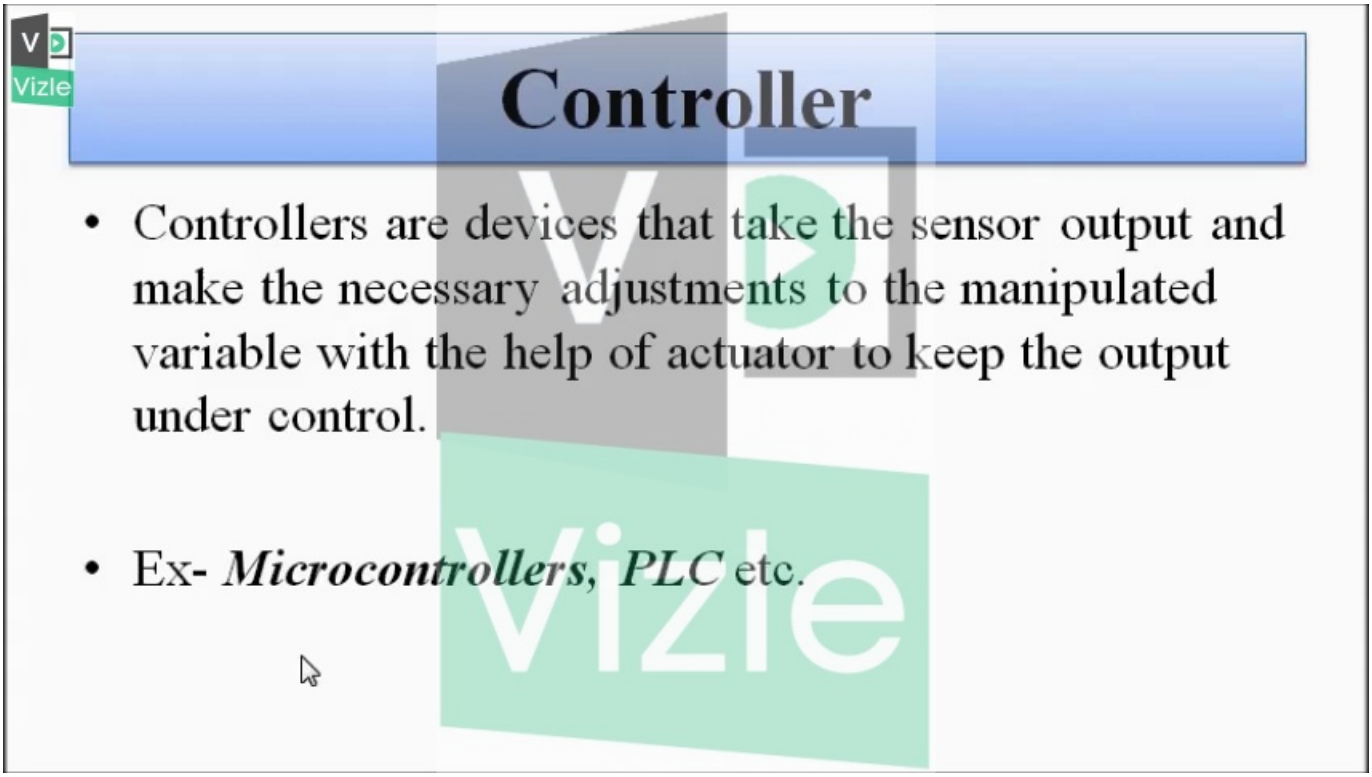
detail so i will not go into much detail here so basic

examples are rtd thermistor thermocouple which are

used for measurement of temperature bottom tube bellows

which are used for force and pressure measurement

then the controller



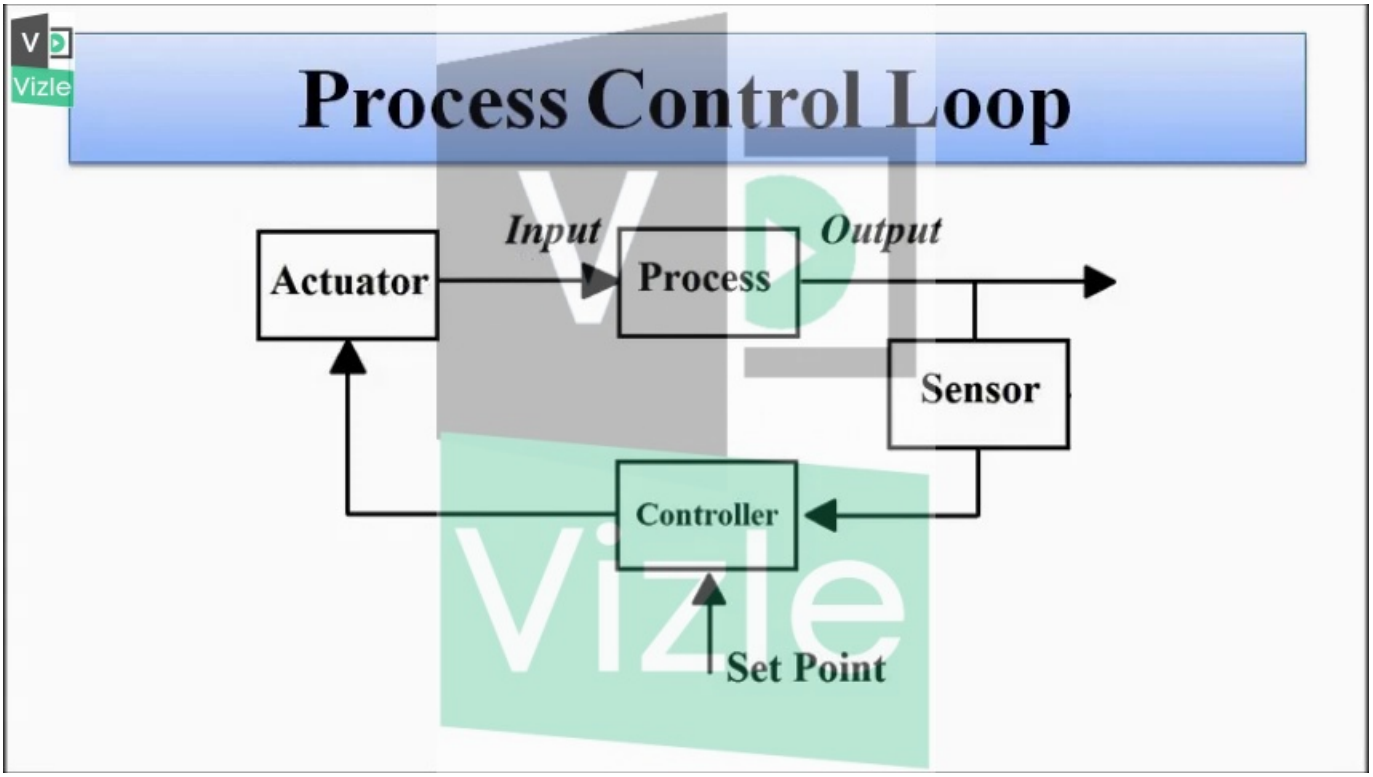
so the controllers they are basically you know devices that take the output of

the sensor compare that output with the set point

value here they compare it with the set point

value and make the necessary changes to the

manipulated variable with the help of the actuator



so basically the controllers that are used

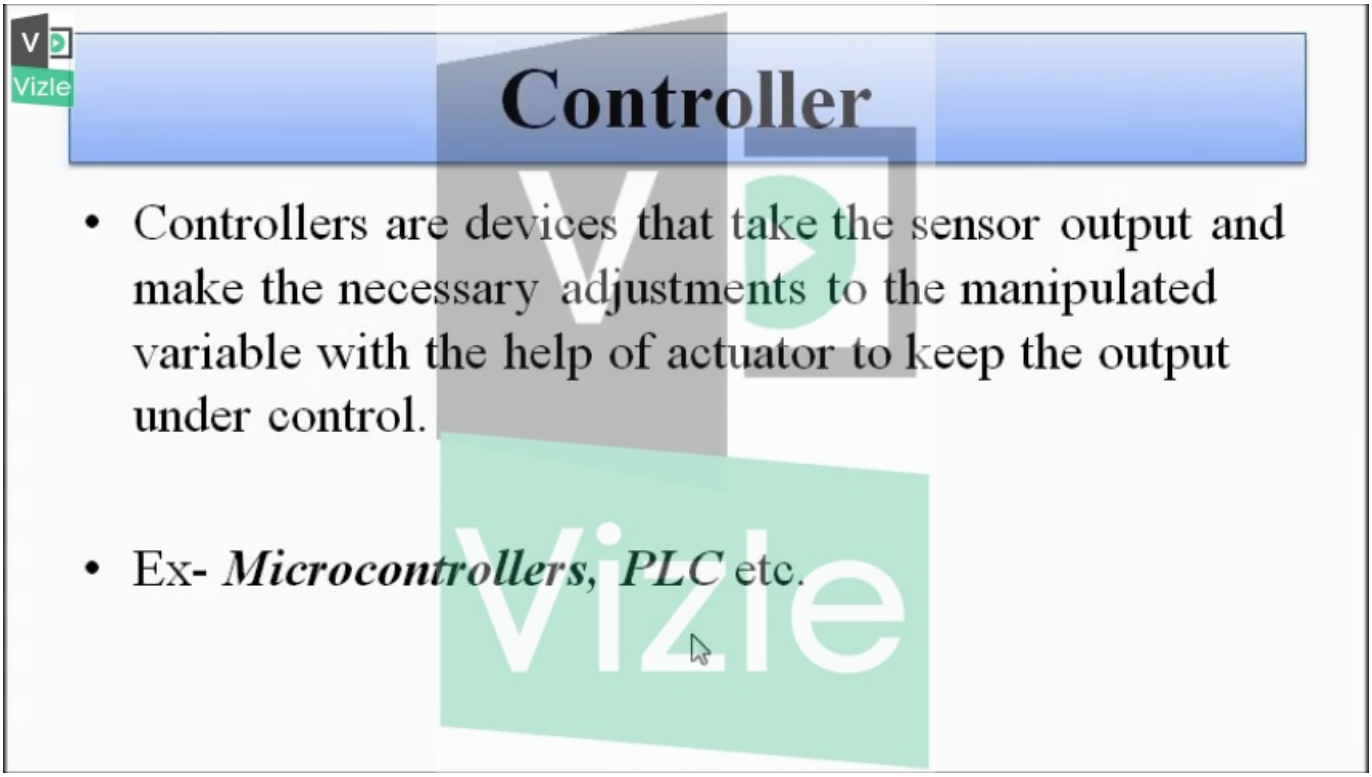
now it is a microcontroller various types of microcontroller configurations

are available depending on the requirement

suitable microcontrollers are used plc scada they are also used they are very

so they are very advanced things i am not

going into detail there will discuss it

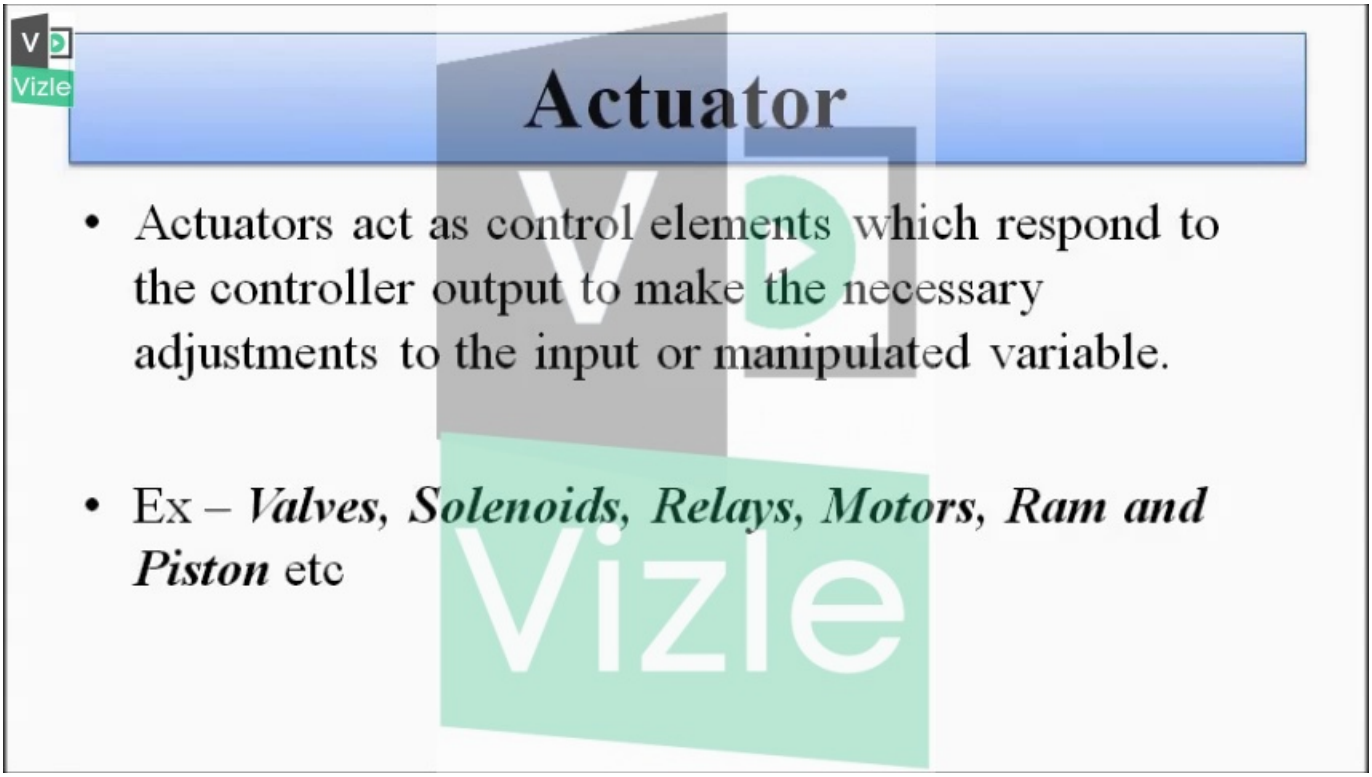


so the controller basically influences the manipulated variable with

the help of the actuator depending on the sensor output

then we have is the actuator so the manipulated variable

has to be changed with the help of some



mechanism okay so

that element which changes the manipulated variable the input

variable on the command of the microcontroller

is called as the actuator okay it can be mechanical mechanism hydraulic mechanism

pneatic mechanism or electrical mechanism

it can also be electromechanical so there are various combinations there

basic examples of actuators are the machines the basic machines it can be

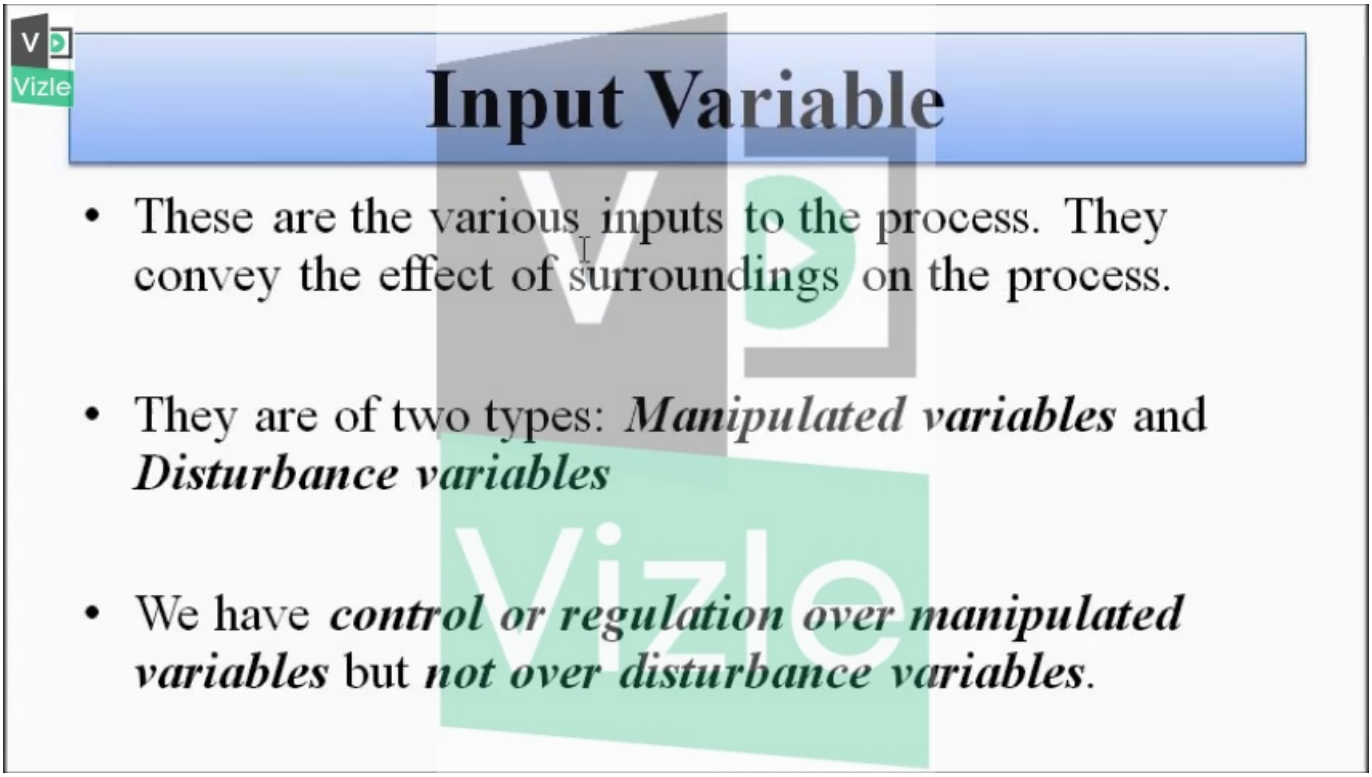
hydraulic pneatic or electrical valves are used solenoids are used

relays are used motors are used ram and piston

arrangements are used they are basically used for pneatic and hydraulic the ram

and piston arrangement so that is the job of the actuator so

the other parameters associated with here is the input variable



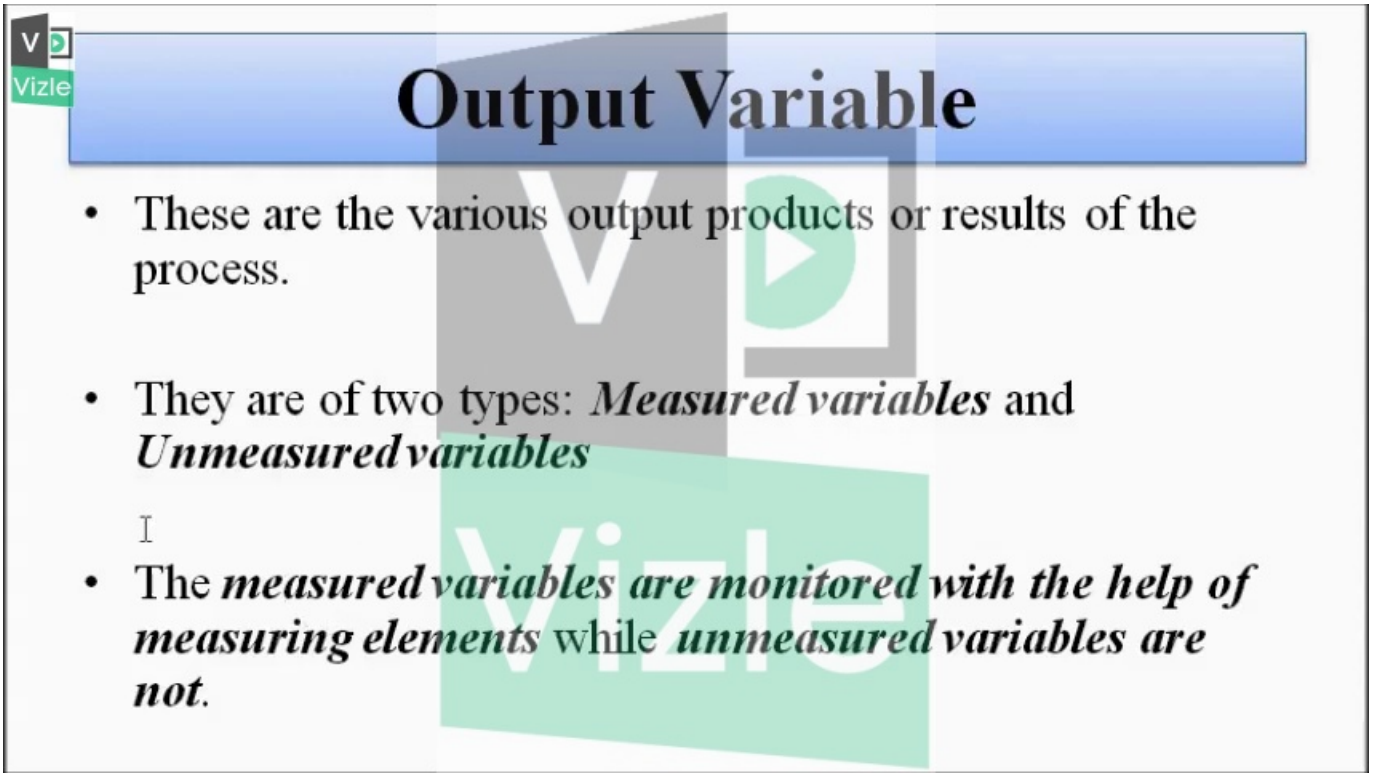
so there are various inputs to the process

now two types of inputs are there as i said here

first is the manipulated variable which directly controls the output variable or

the control variable then the unnecessary inputs called as

disturbances so the various

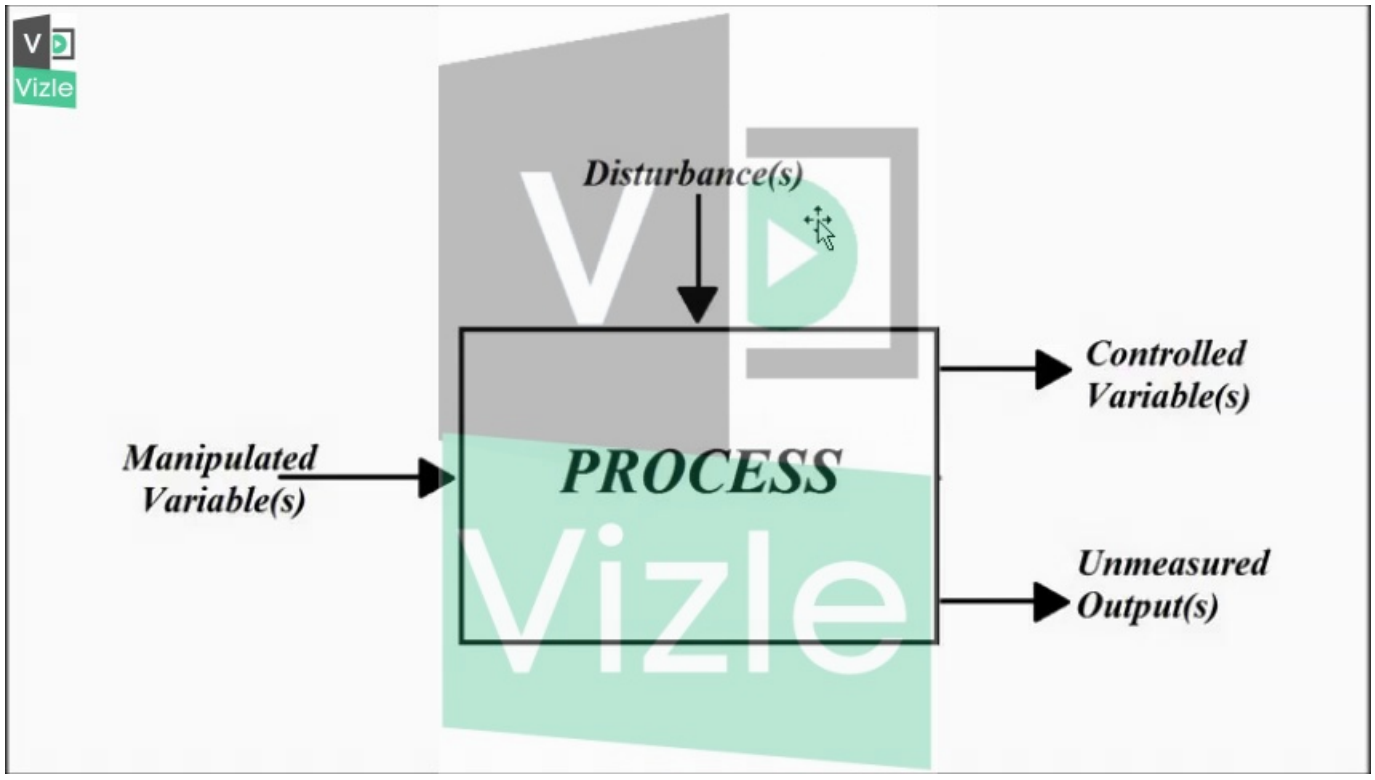


input variables they are controlled or regulated you know

the manipu they're manipulated to give us the necessary

output variable that is why it is called as manipulated variable

disturbance variables are not within our control



okay they unnecessarily affect the process

then we have is the output variable so the output variable which we want to

control or which we desire to control that is

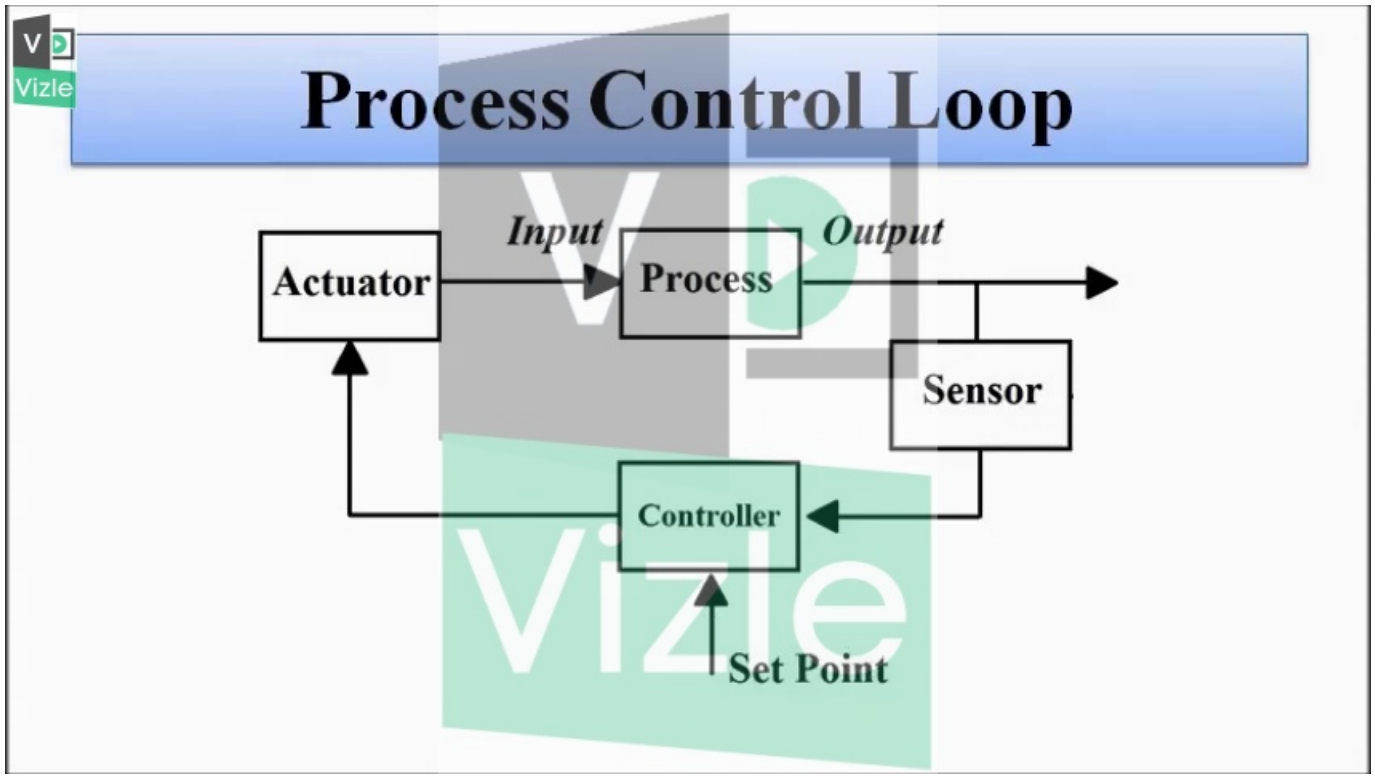
the control variable and the byproducts which

which are a result of the process that is the unmeasured output okay

and then we have is this set point so the set point is the desired value of

the output which we want okay as i said it is the output which we

want that is defined by the set point so it acts as a reference

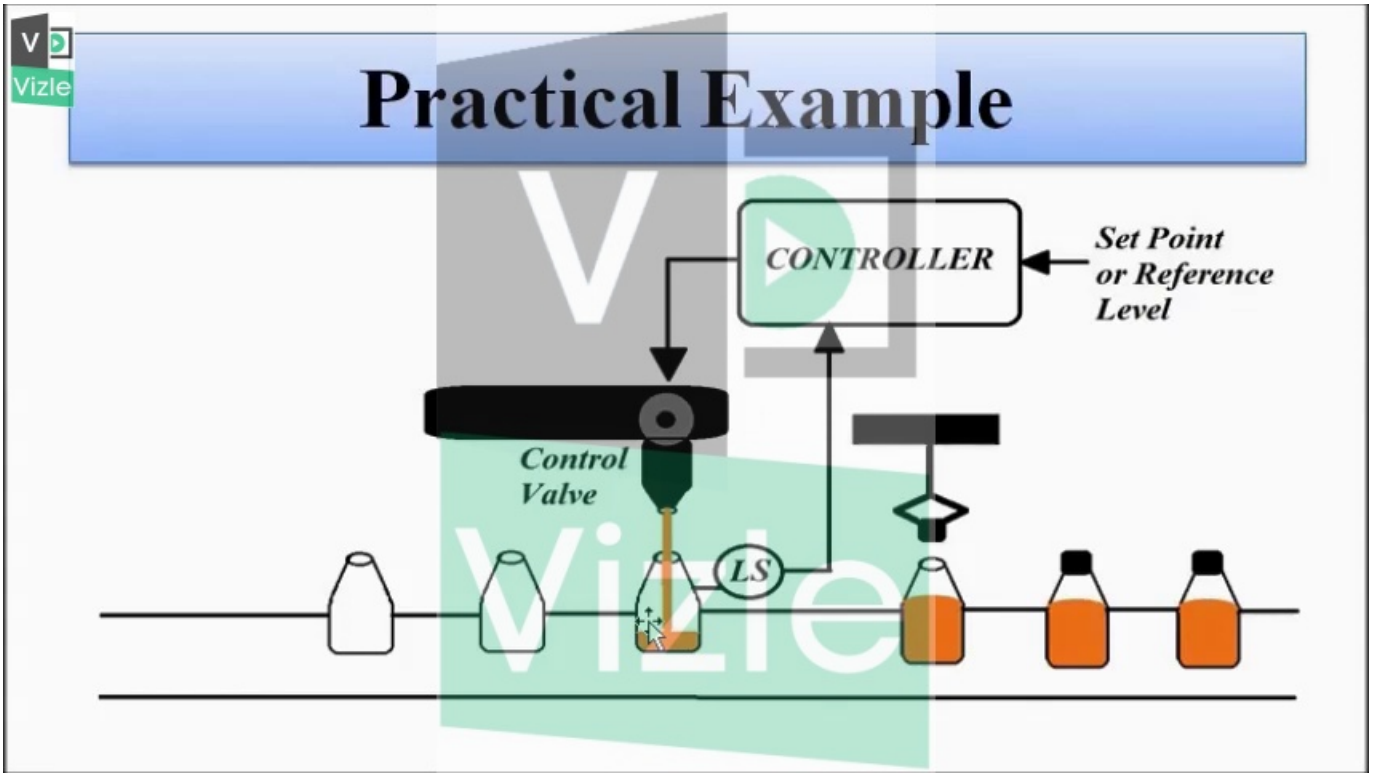


okay for the controller to keep the output within a specified

range now let us understand this with the help of a simple example

so we'll take the example of you know the packaging of any beverage

or juice in the food processing industry



that we have suppose we have a mechanism

where ah you know the bottles they are filled with

let's say orange juice now you may have noticed

that in all the packaged drinks the

the liquid or the drink the beverage it it is always

filled to the same level okay all the bottles

in a particular stack or crate they always are filled

to the same level identical they are identical in their

you know the level to which they are filled

so how does that happen if it is done by any han being

there will always be some minor difference

some will be filled completely to the tops and

in some cases there will be some gap left if it is done by a han being

there will always be a margin of error the margin of error will always be huge

but when it is done by a machine then

the drinks they are always filled to the same level

okay so here the the error it is less so how does that happen let us just take

a simple example so what happens is that the

bottles they are filled with a particular juice or drink let us say

orange juice so there is a level sensor which

detects the level of juice in a particular container or

particular bottle then it sends that signal to the

controller a microcontroller let's say in this case

the microcontroller is fed with a set point or reference signal

which gives us which which gives it the information

of the level up to which each of these bottles

should be filled so depending on that the controller adjusts the

valve which through which the juice flows through the bottle so it regulates

the position of the valve which adjusts the flow rate of the juice

flowing into the bottle so when the juice reaches the level

which is defined by the set point the valve stops

the flow of juice stops and it moves on okay so the level sensor continuously

measures the level of the juice in the bottle

as it reaches the level defined by the set point

the controller issues a signal the control valve closes and the flow rate

of the flow of juice into the bottle stops so

all these bottles are filled up to the same level

with orange juice so that is a basic example

so here the output variable which we want to

control is the liquid level or the level of orange juice in the bottles

that is the controlled variable the output variable

which we want to control that is the output control variable okay

the liquid level in the bottle is the output control variable the

orange juice how we are controlling it how are we

controlling the level of orange juice in the bottle

with the help of this control valve regulating the flow rate of the juice

so the variable through which we are controlling the output

that is the level of juice in the bottle that is the manipulated variable so the

manipulated variable in this case is the flow rate of the juice which is

controlled using the control valve that is the flow rate the input

manipulated variable so here the control valve is the

actuator the controller can be a microcontroller

set point or reference is the level up to which we want to

fill the bottle it can be anything it can be in terms of

centimeters or it can also be in terms of vole

so there are different parameters that we want to

that we can decide depending on the manufacturer or the industry

industry standards so a level sensor in this case can be a potentiometric

level sensor it can also be a capacitive level sensor

so there are many choices so what type of sensor is being used that is the

choice of the industry so the level sensor detects the level of juice in the

bottle continuously measures it measures it

sends the signal to the controller as the juice reaches the level defined

by the set point the controller issues a signal to the

control valve the control valve closes flow of juice to the bottle stops so

that is the basic example of a simple example of a simple

process control loop used in industry ok

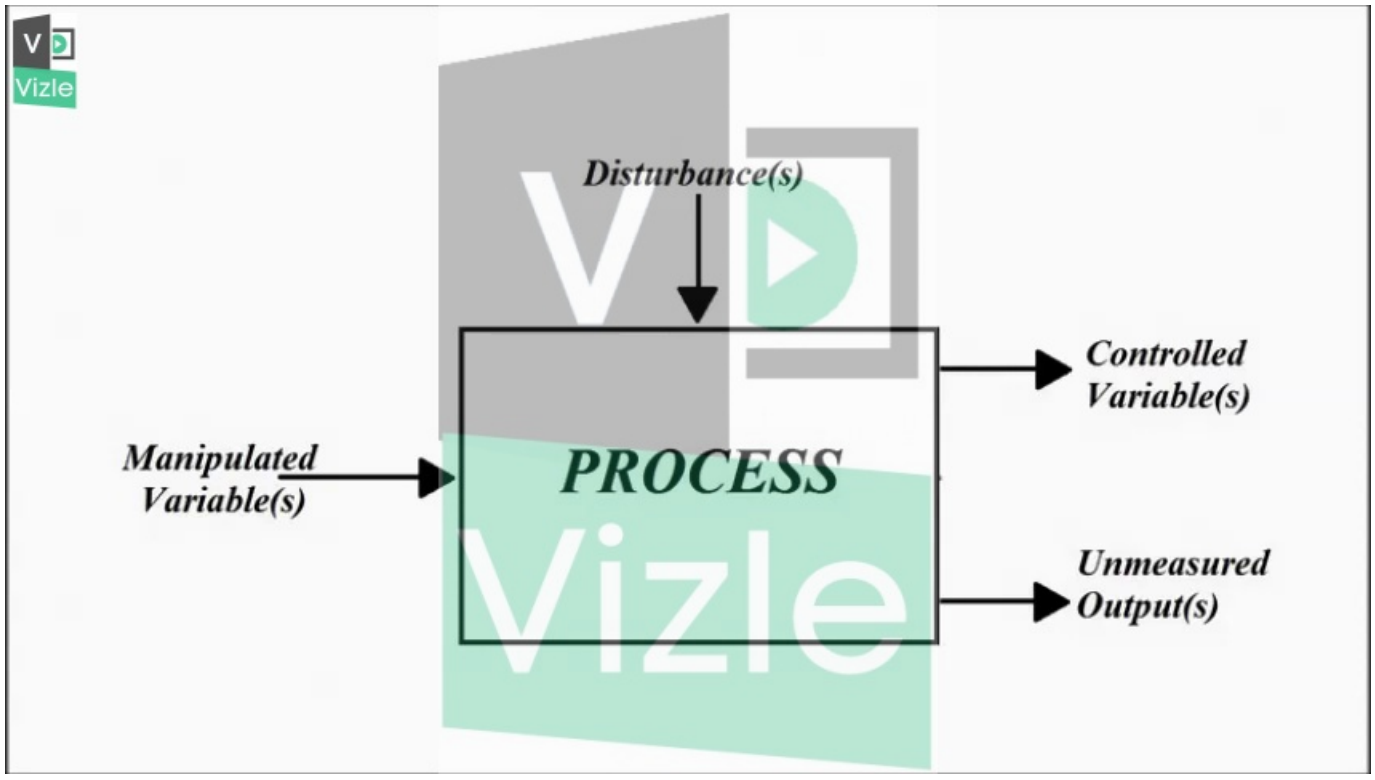
so this is all about the basic concepts related to

process control and instrentation okay so in the upcoming videos we'll discuss

some more concepts related to it so i hope you like this

video and please subscribe my channel engineering tutorial

for more such videos related to electrical electronics instrentation



and communication engineering have a great day thank you very much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