Introduction to Internet of Things
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Lecture – 24
Integration of Sensors and Actuators with Arduino- I

This lecture and the next one are dedicated to discussing the integration of sensors and actuators with Arduino platform. So, in a previous lecture we have taught you about how to you know what is Arduino and how to use it for building IoT systems and in this lecture we are going to show you further that how we can integrate sensors and actuators with Arduino. I told you that a multitude of several types of several types and several sensors can be integrated in to Arduino platform it supports for that and at the same time seen for are actuators as well. So, here I am going to teach you about how to do it.

And I have with me Mister Anand Rao Mukharji the TA of the course and he will explain to you how to do this hands on. So, as I said before that if you have the set up e if you have the requisite small electronic equipments with you then you can also do the same to practice yourself. So, that way it will give you a hands on experience about how to create a small scale small sized sensor actuated based Arduino platform for used in IoT. So, this specific type of sensor that we are going to show you here we are using only one sensor and we are using only one actuator, the sensor that we are using is the temperature humidity sensor and the actuator is the motor the survey motor.

So, let us know have a look at how to build a small sensor actuated based Arduino platform for use in IoT.

Hello I will be now talking about the integration of sensors and actuators with Arduino. So, this will be again in two parts in the first part I will cover integration of sensors with Arduino and in the second part integration of actuators with Arduino.

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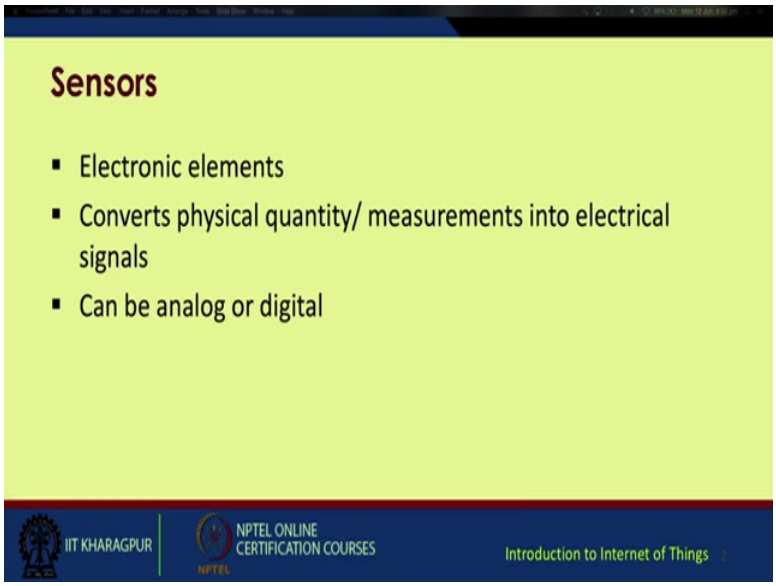

So, first of all as we have already learned by now; sensors are basic electronic elements they convert physical quantities or measurements into electrical signals and more or less sensors can be classified into either analog or digital sensors.

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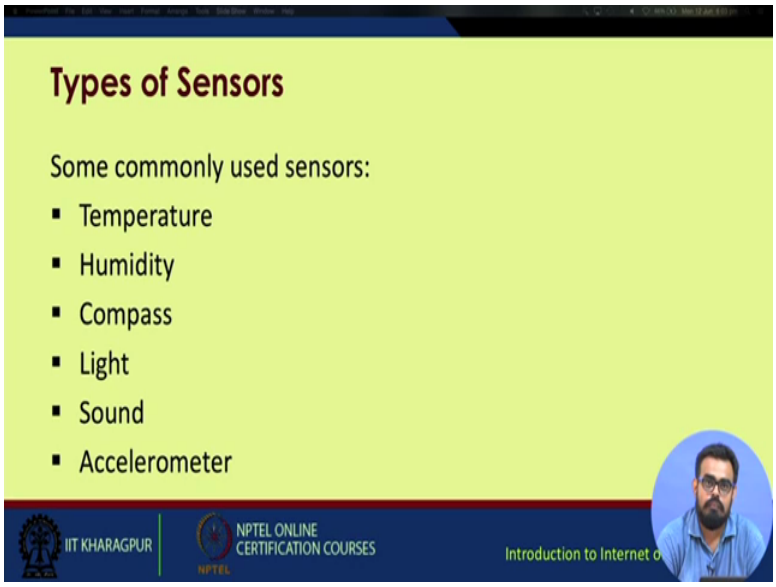

So, there are few common type of sensors we actually use with IoT they include temperature sensors, humidity sensors, compass or direction sensors light sensors, sound sensors accelerometers or mission sensors.

And there are lot many verities of sensors we could not accommodate everything over here, but I am sure if you find search online you will come across huge number of sensors.

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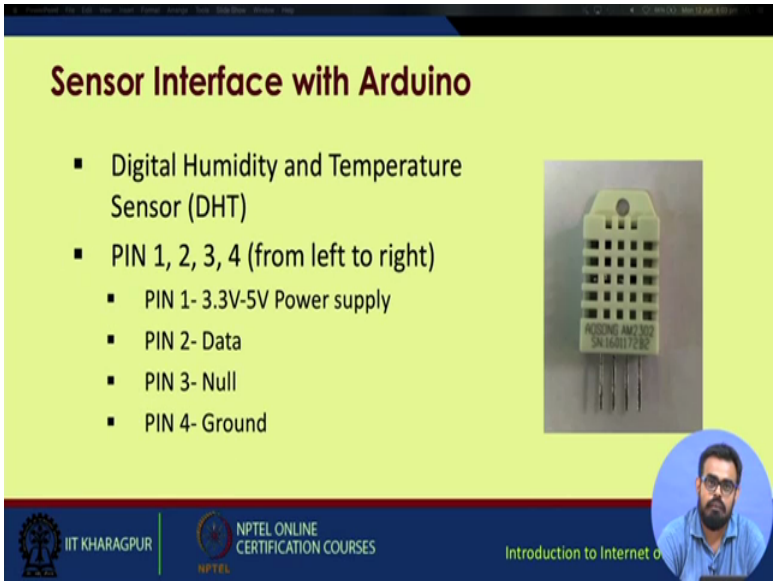

So, now in this lecture will be covering interfacing of a humidity and temperature sensor with your Arduino board. So, in our previous lectures we use an Arduino uno just for the sake of bringing in some variety.

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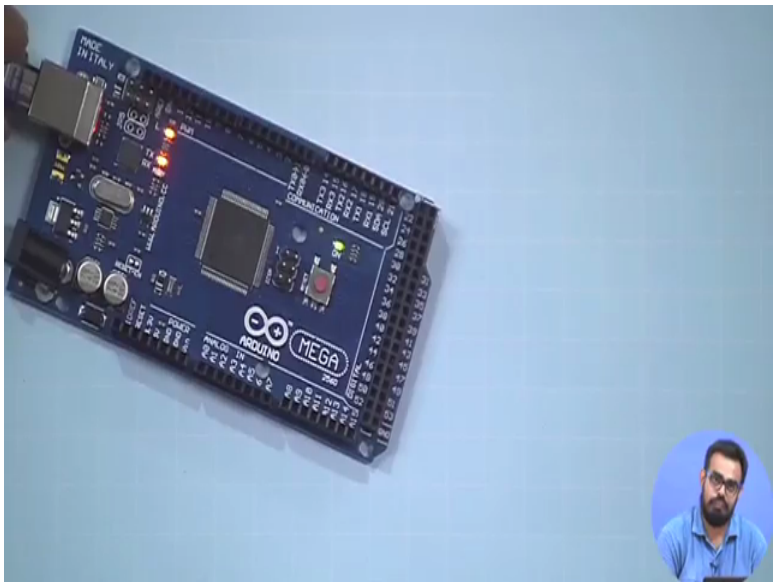

Now, we are using and Arduino at mega; so, Arduino mega. So, in the market you can just get it by the name of Arduino mega or mega 2560. So, its bit bigger than your traditional Arduino

uno this one has got 4 uarts, Arduino uno if you recall had only one uart and obviously, there are much more digital input output pins there are much more analog input pins.

There are 16 analog input (Refer Time: 04:22) 7 for 7 or 8 for your uno, and the voltage inputs and power lines are more or less same. So, we take this one.

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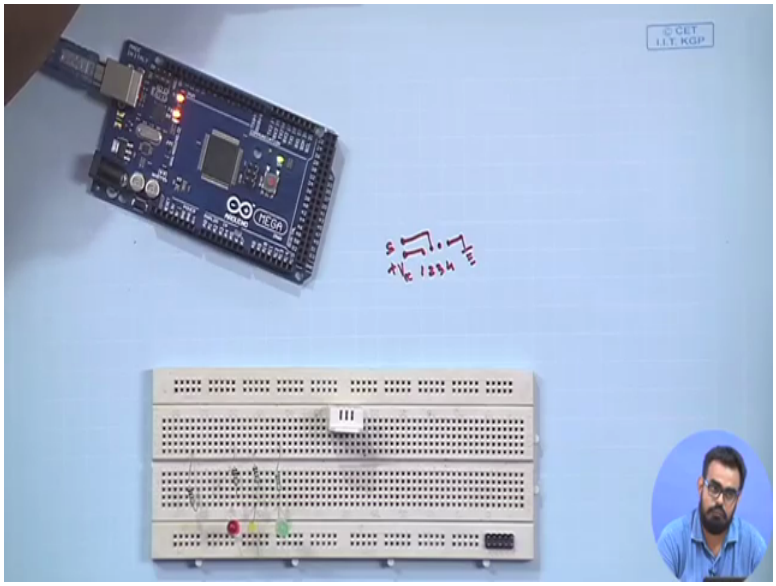

Now, we again have are breadboard. So, these we have (Refer Time: 04:41) the LEDs and registers left from the previous slides, this one is known as a DHT sensor. So, DHT stands for digital humidity and temperature. So, as we can see it has 4 pins and starting from left to right if you keep this upfront this mesh region upfront starting from left to right you number them as 1 2 3 and 4. So, basically you have four pins pin one we give a positive voltage the last pin we keep as ground, the third pin is the signal pin and the sorry the second pin is the signal pin and the third pin is left open or no connection.

So, following this basic connection idea we put it on the breadboard; now your pin one has to be connected between to a supply ranging from 3.3 volt to 5 volt you should take precautions not to exceed this 5 volt range, otherwise your sensor will be damaged. Pin 2 is the data pin from which the actual sensor data is coming to the board pin 3 as I have told you before it is null on no connection and pin 4 is ground.

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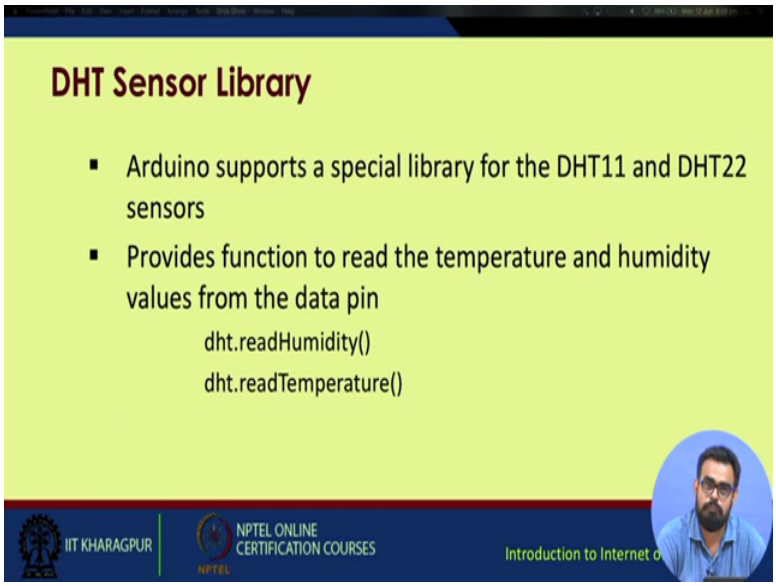

So, prior to interfacing the hardware with the Arduino ide, we actually need the support of a few libraries available online. So, this sensor was acquired from your adafruit it is a company which supplies various Arduino boards and related components and other processor boards. So, we are going to use the adafruit library for DHT11 of DHT22. So, this sensor we are using is actually DHT22; your DHT sensor library it provides some basic facilities for reading the humidity reading the temperature and so on.

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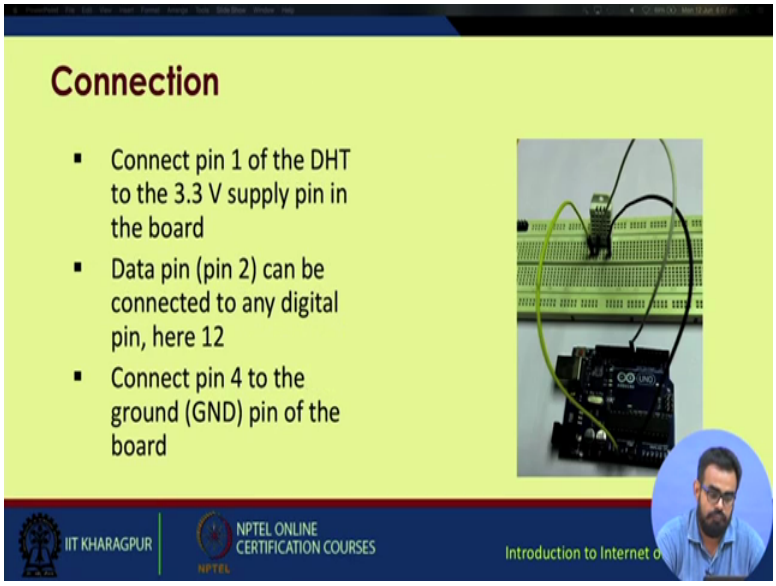

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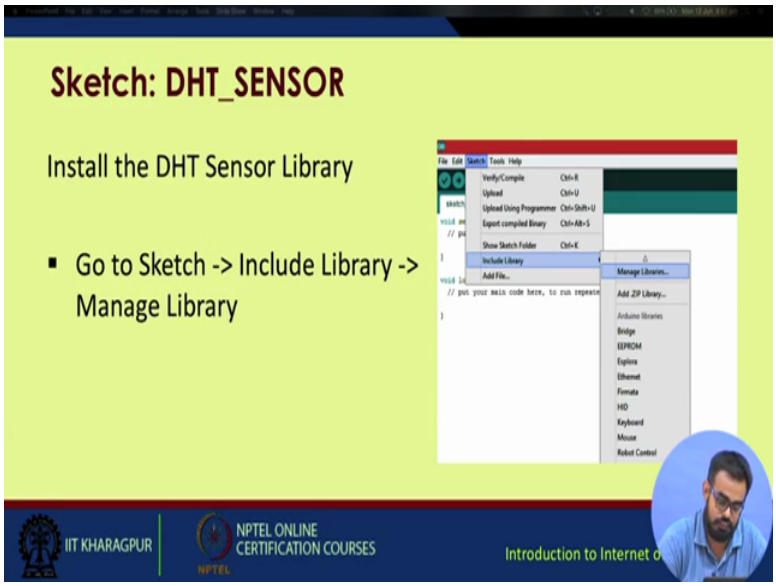

So, for now will just skip the connection first will look for the sensor integration look for the updation of the library your existing Arduino ide.

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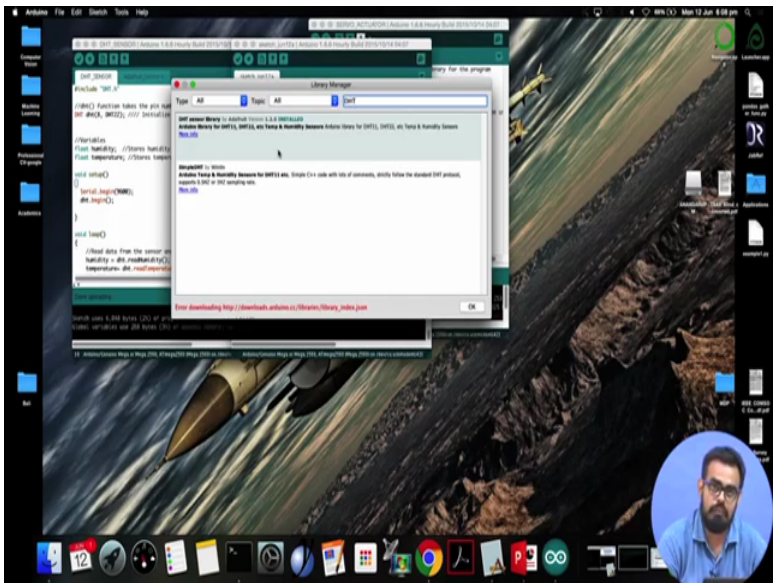

So, we start off with we go to tool sorry you go to sketch on the menu bar then there is a option for include library and then manage libraries generally it is on the top. So, and the library manager you write sorry you just write DHT. So, as you can see I have already installed this library file.

So, you get a DHT sensor library, you just click on it and if your pc is connected to the internet your Arduino ide will do the rest you just download it will download the library integrated with the system you restart your Arduino ide in you are ready to go. So, as I have already installed this library no need for anymore action.

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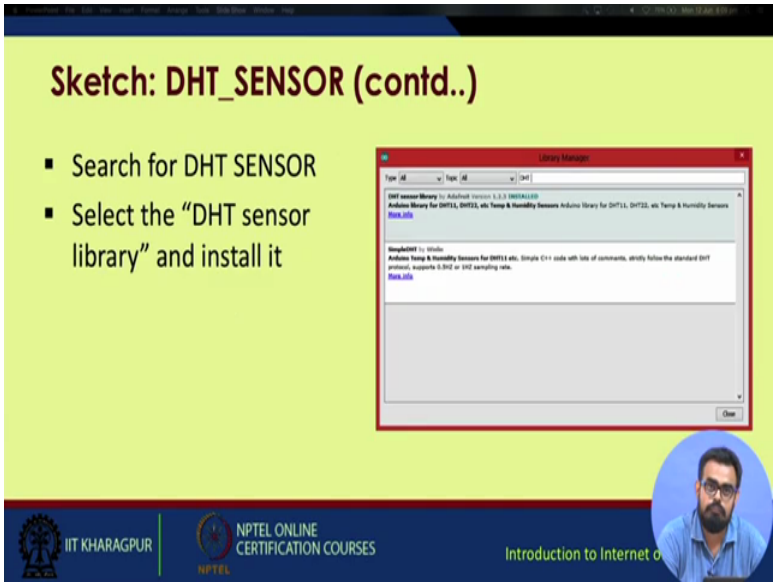

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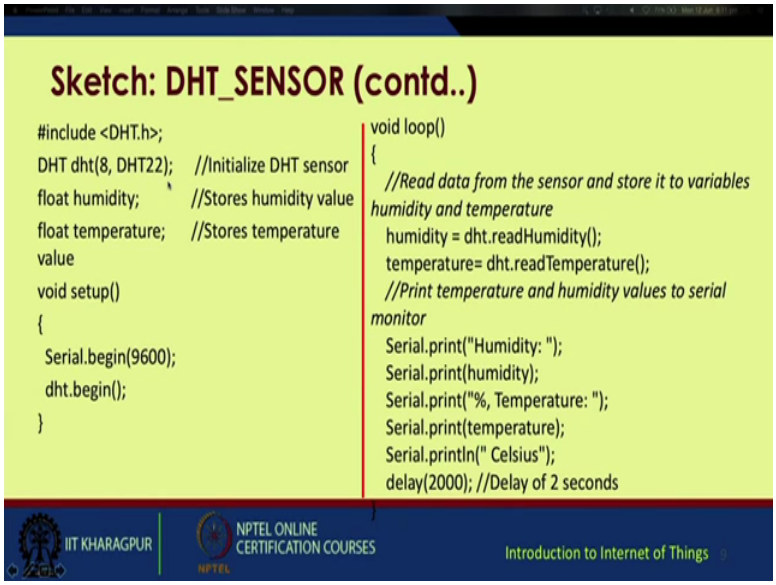

So, this is actually how you update the Arduino ide with the required library. So, you have already selected the DHT sensor you click on it and it installs.

Now, coming to the actual sketch for the DHT, prior to that will just install the hardware with the Arduino board. So, if you recall these four pins starting from 1 2 3 and 4 you place it on the breadboard.

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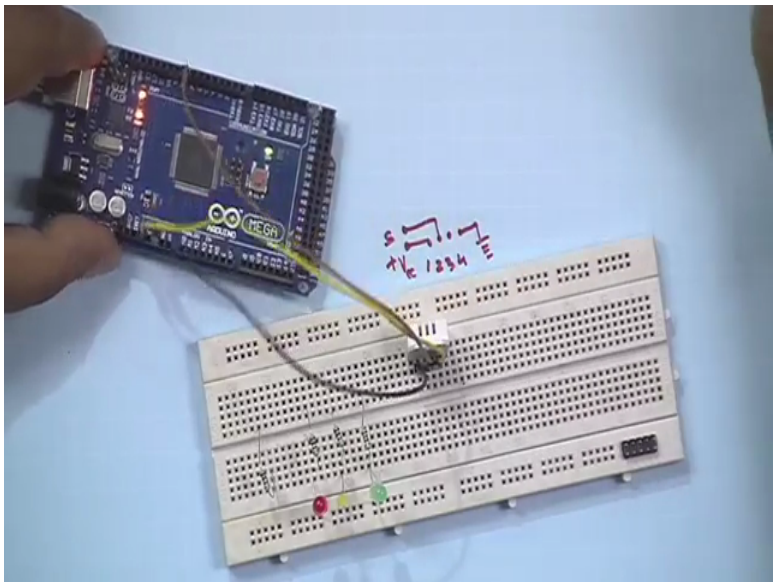

We take four jumper cables. So, pin 4 was ground, I connect pin four to ground pin one was Vcc it should be between 3.3 and 5 volt, just to place if I will putted at 3.3 volts, and pin two is the actual signal input which will come to the Arduino board. So, let us say we choose any digital port let say we choose pin number 8 or port 8. So, we connect the signal wire from the DHT to pin 8, you can choose from any of the digital input output pins. So, now our hardware is ready it is quite easy. So, focusing back to the sketch part for the DHT sensor, this you have to for this you have to include the library file you downloaded it contains a few header files and other definitions. So, you must include that particular library file. So, first line is hash include DHT dot h right.

Then from its own syntax from the syntax of the DHT sensors library installed you just call DHT then DHT pin and sensor. So, you are initializing that DHT sensor. So, this is the syntax and we have to follow this syntax strictly because it is according to that library we just downloaded, now we are defining to variables both of floating type. So, one is float humidity and another is float temperature right. So, the humidity this variable humidity will store the humidity values acquired from the sensor and temperature will store the temperature values acquired from the sensor.

Now, within the setup since we are going to view whatever readings we have getting from the board or the sensor on the serial port, we just initialize the serial connection. So, again serial dot begin at broad rate of 9600 after that we initialize the DHT DHT dot begin. Over here in the second line you have just assigned your DHT to pin number 8 and we have given that sensor as DHT 22 suppose you go for the variant DHT 11 then you just update this part as DHT 11 or if you plan to change the pin number on the Arduino board you have update that part over here. So, once the setup part is complete you go into the looping part.

So, over here you can see the variable humidity it is being assigned the DHT dot read humidity function. So, whatever function whatever sensor offsets and operations need to be done is being taken care of the taken care of the DHT dot h library. So, you just call this function read humidity, then temperature as DHT dot read temperature once you have call these to you just serially print these variations. So, as I have given a delay of two seconds. So, after every two seconds your humidity and temperature will keep on updating.

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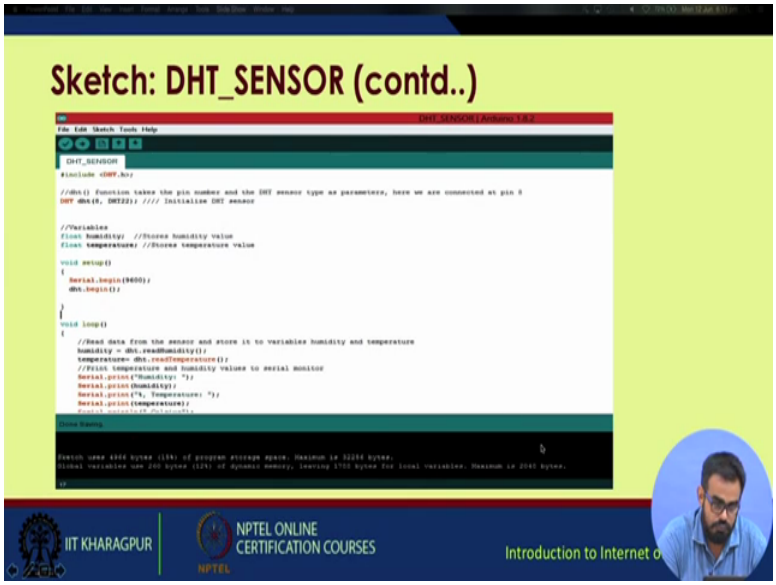

So, let us go to the next slide. So, we have already interfaced these sensors this is the code you just saw in the previous slide this one, then again we go through the basic steps we connect to board to the pc.

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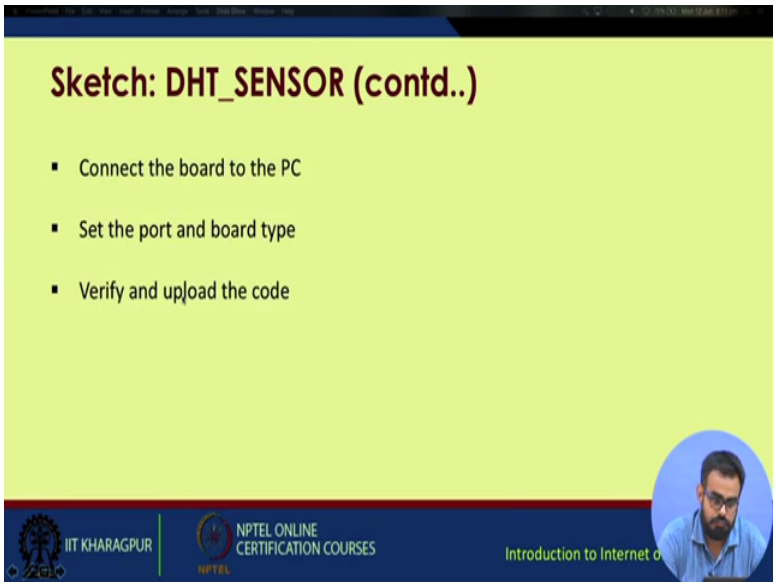

We set the port and board type now remember the port and board type may change because board type will definitely change, the port may or be not change for this we mega. There will be an option for mega we chose it then prior to uploading we verify the code and then uploaded the code.

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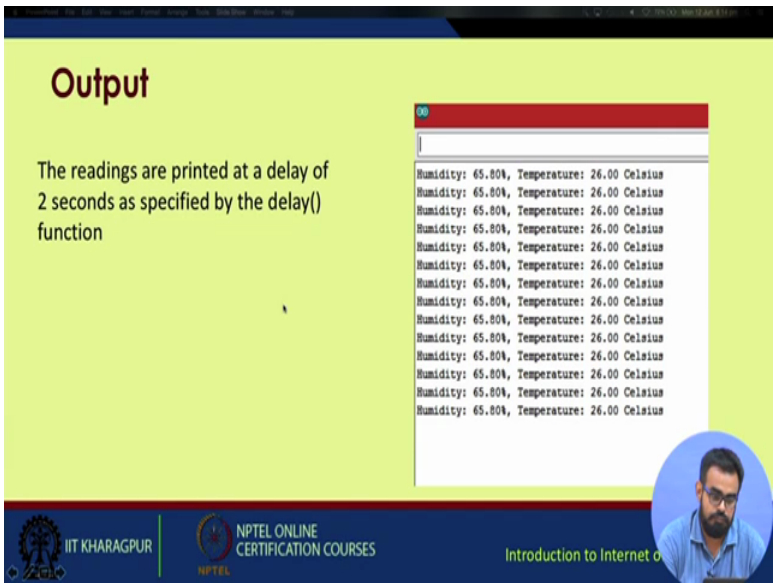

So, this is the output we are expecting like humidity is giving in percentage and temperature in degree Celsius, and these each row is separated by time duration of two seconds. So, after every two seconds your temperature readings and humidity readings are getting updated.

So, now, back to the hardware part.

So, I have already has the code open end in front of me.

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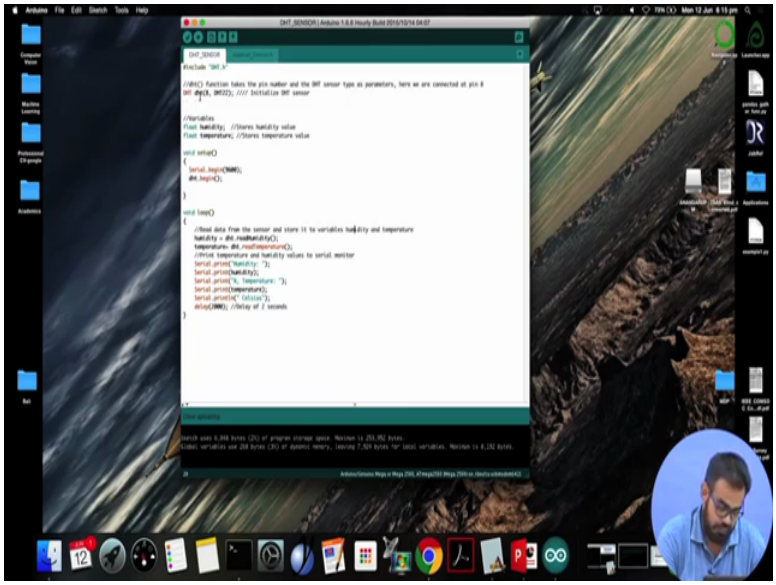

Right as you can see hash include DHT dot h then we have set the pin number at 8 in the input pin sensor type is DHT 22 humidity flowed temperature within void setup serial dot begin at broad rate 9600 DHT dot begin. So, setup is ready and within loop we just call the humidity and the temperature reading functions and that is it and just serially print it over and over again with the delay of two seconds. Now sense everything is connected we just verify our code. So, its compiling the sketch; sketch is complied there is seems to be no error.

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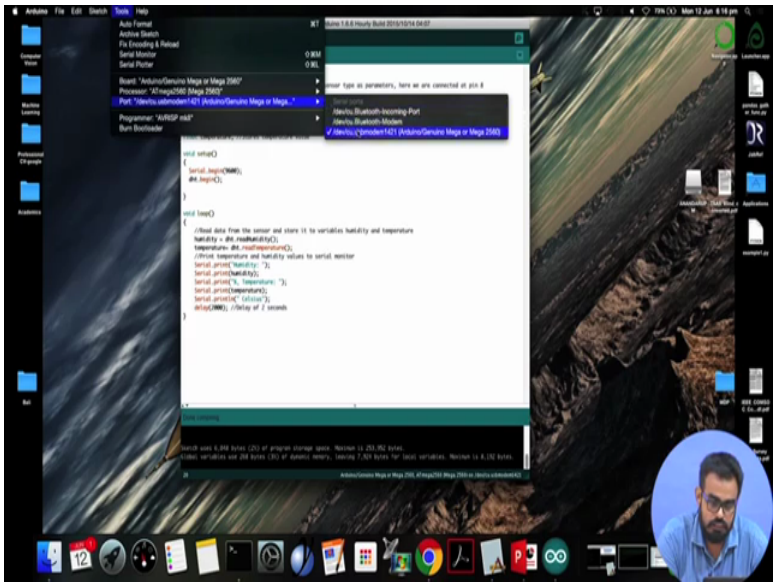

Prior to uploading will choose the board has already been chosen as Arduino mega or mega 2 5 6 8 0 sorry 2 5 6 0 the port is already set now we can safely upload our program if you pay attention to the Arduino board you can see this board over here.

We have uploaded the code to the board as you can see now I will again upload the code these two lights the tx and rx whenever you are uploading it, they will bring blink rapidly; that means, your code is being uploaded. So, now, your code has been uploaded just for the sake of it you just press the refresh button now we open the serial monitor.

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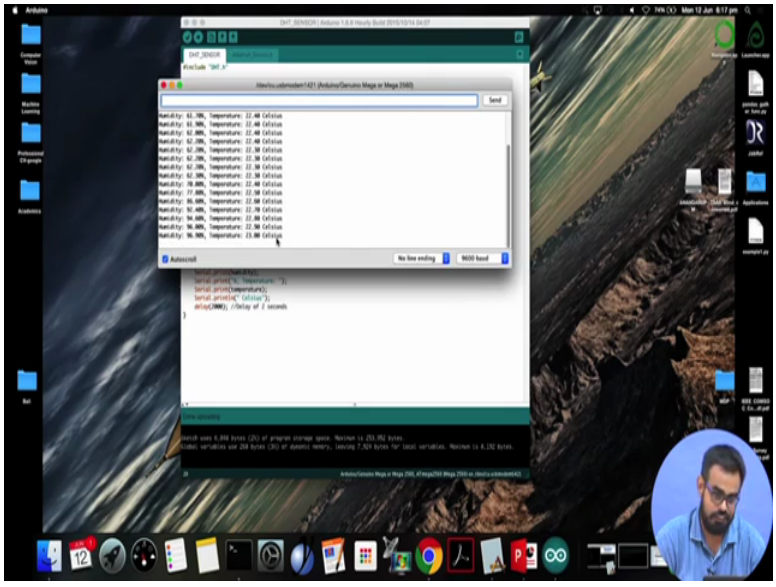

As you can see your humidity and temperature readings are changing. So, may be if you can light a fire in front of it temperature readings go up, and this hoping the temperature changes a bit you see yes the temperature is changing, but very slowly 22.7, 22.8 it will keep on increasing I am hoping to let as reach my body temperature is now its touching 23, the humidity is almost 98 percent 98.6 percent and so on. So, I hope you get some ideas and you can thinker around with these stuff. So, these are some of the basic sensors other sensors you can; obviously, integrate are like depending registers you can integrate light bit sensors you can integrate accelerometers gyroscope those are a bit complicated, but yes they are find to work with. So, that was the part covering sensor integration with Arduino.

Thank you.