

Embedded System Design with ARM
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Lecture – 23
Interfacing with 7-Segment LED and LCD Displays (Part II)

Welcome to lecture 23, in this lecture we will be demonstrating you with how we will, we have already shown you the interfacing, like how will you will be interfacing with LCD, with 7 segment, with LED ok.

Now we will be doing and demonstrating you the experiments with the two set of boards. So, let us see that. Welcome to the experiment on LED interfacing, basically the 7 segment LED. I have already discussed about what is a 7 segment, how it works. There are two types of 7 segment display that we have, one is common anode another is common cathode ok.

So, in this experiment what we will be doing is we will be taking a 7 segment which is a common anode 7 segment. So, in a common anode 7 segment we will be connecting the common point through a resistor to VCC and to glow any of the LEDs or any of the segment we have to pass a 0. So, that way we can first check whether all the LEDs are working fine or not and then what we will be doing in this experiment is that we will be glowing the LED in some fashion, we will start from 0 and it will be a going to 1. 2 up till 9 and when it reaches 9 I will make that 9 to 0 ok.

So, it is a kind of counter which will count till 9 and again when it reaches now, it reaches 9 it will be initialized to 0 again ok. So, let us directly come to the experiment ok.

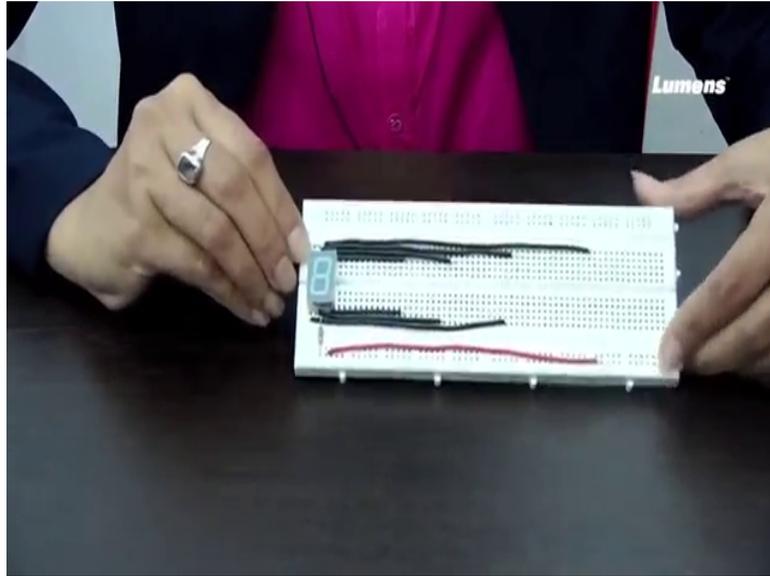
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So, see this is a 7 segment display, you must have seen this in many places ok. So, let us see what is the functionality or what are these segments. So, we already discussed. So, this will be a segment, this is b, this is c, this is d, this is e, this is f and this is g and this point is the decimal point we call it d p ok. So, these are the segments that we have in this 7 segment display.

You see these are the pins. So, this is basically this pin will be like corresponding to this one this will be a b, this will be a b then d and so on. So, this is how it is connected and this is the common point, this segment is the common segment. So, as this is a common anode 7 segment, this from this particular point through a resistor will be connecting to VCC and to all other segments to glow we have to pass a 0 into it ok.

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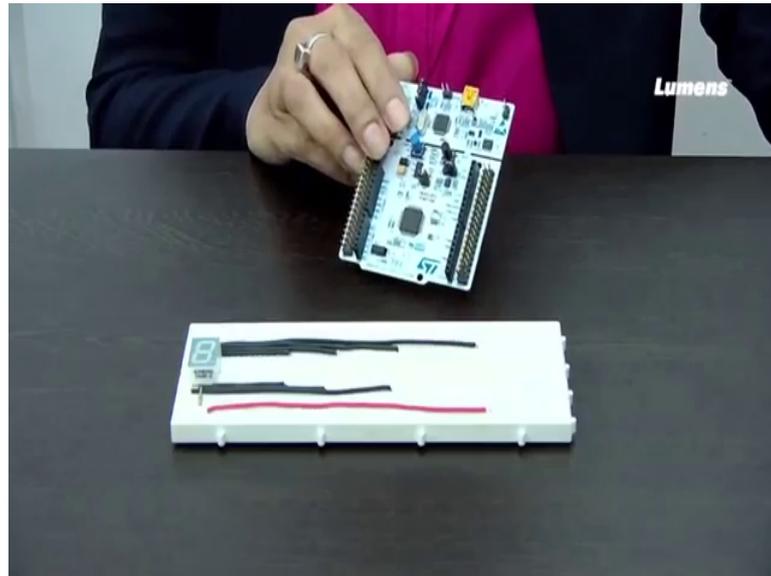
So, now I will be showing you the connection first with STM board so this is this is already I have made it, this is the 7 segment.

And from the common point through a resistor I have connected this to this point. So, from any of this point I can take and I connect to VCC and to all these points. So, this is a, this is a segment, this is b segment this is c, d, e, this is f and this is g. So, accordingly I will be connecting these segments to some of the digital output pins of both the boards ok.

As I have already told you I will be using pins from d 2 to d 8, basically and the common point will be connected to VCC and then I will be writing the code where each segment will glow for little bit more than 1 second and then it will move to the next one and starting from 0 till 9 and when it reaches 9 it will be again initialized to 0 ok.

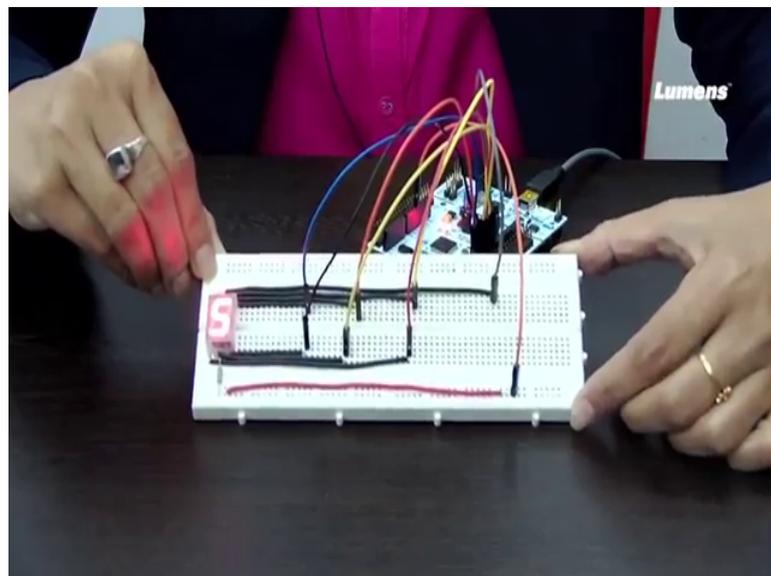
So, this is the first step you have to make the connection in this fashion. So, let me connect this with STM board first.

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So, this is my STM board as I have told you I will be connecting it from d 2 to d 8.

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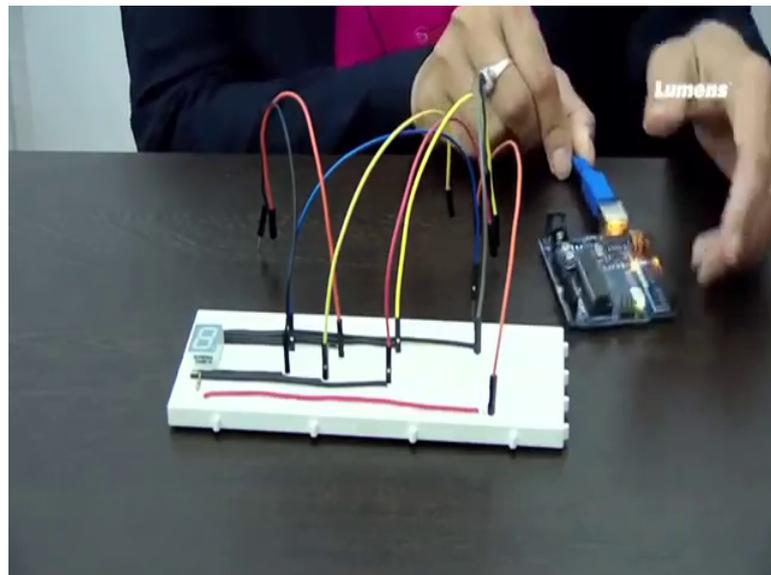
Connecting this to d 3, next I will be connecting c to d 4 then d to d 5, e to d 6. Now f to d 7, g to d 8 and as I said from the common point so this is the common point through register, this will be connected to VCC ok. So, now, what I will do? I will dump the code which I have already written into the STM board, I will connect it let us see ok.

Now, you see what is happening, what is happening? It is glowing each one of the segment for that particular numerical value. So, if it is 1 you see that only 2 segments are

glowing if it is 7 3 segments are glowing, if it is 8 mostly all the segments are glowing. So, this is how you have to pass that particular code such that it will glow ok. So, this is how you have to program.

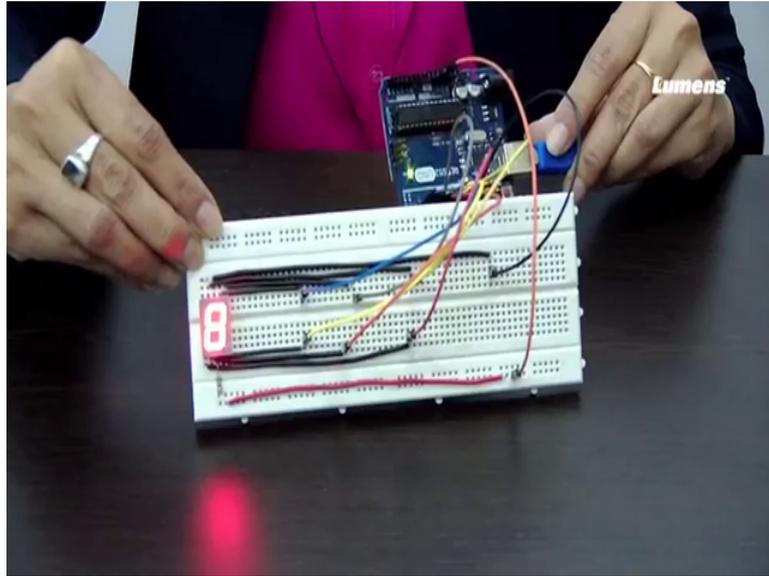
So, what I did? I made the connection. So, from common point I connect to VCC, you can see this is the VCC point that I have connected this one and then all the other segments I have connected to from d 2 to d 8, I have connected it to from d 2 to d 8, it is up to you how you connect accordingly you have to pass the particular code and you have to change the code accordingly. Where you are connecting it to which digital output port you are connecting accordingly you can actually do it. So, this is the code using an STM board. Now I will be doing the same thing with your Arduino board.

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This is the Arduino board ok.

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Let me make the connection first, this is the ground oh no this is the VCC and then from d 2 pin d pin 2 to pin 8 basically I will be connecting, ok. Let me do the connection then this is with d 2 sorry 2 pin number 2 this is with pin 3, this is with 4, this is with 5, this is with 6, this is with 7 and with 8.

And this one will be repeat. So, please see that my connection is ready ok. So, the connection is ready. So, this common point I have connected to VCC and from pin 2 to pin 8 I have connected a b c d e f and g ok. Now I will be connecting this connector and we will be putting up the code. Now see I have put up the code into this Arduino board, the same code which I have written for STM board and it is glowing.

So, when it becomes 9 it is going to 0 again and then to 1 2 and 3 then 4 then 5 then 6, then 7, 8 when it becomes 9 it will go to 0 again this goes on ok. So, so these are the two experiments, I mean the same experiment basically I have shown using both the boards, you can try out doing something else I have here printed from 0 to 9.

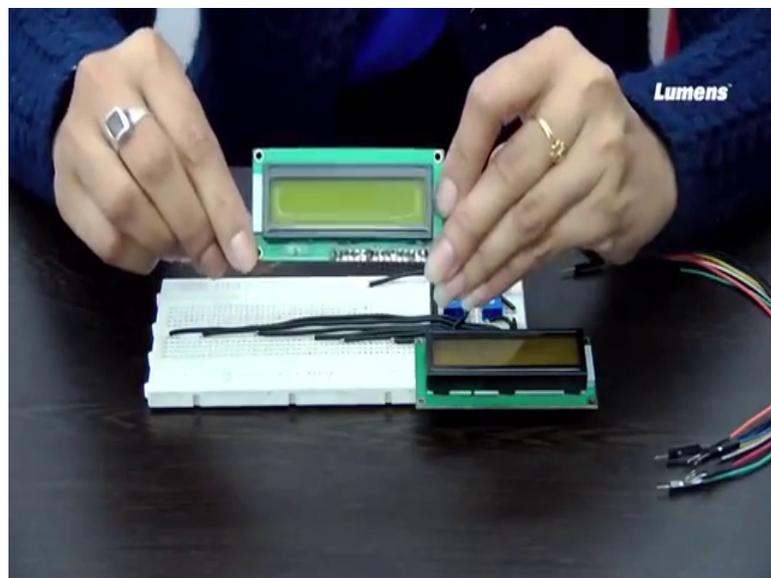
And when it becomes 9 it is going to 0 you can make a different kind of counter you can make a counter from 0 to f, after 9 a b c d e and f and when it reaches f it will change to 0 again or you can make anything else. You can display something in the 7 segment display using some other programming for some maybe other experiments you can use it this for only displaying something. So, we will see that where we can use the 7 segment in other experiments in course of time ok.

So, today I will be explaining you how we can interface LCD, the same LCD that we have already discussed in the PPT, the same LCD that is j h d 16 to a LCD that we will be interfacing today. Now the thing is that this particular LCD as I have already told you can display 2 lines, 2 lines of text maximum of 16 characters in each line and if the text goes beyond 16 characters then what happens it scrolls. I have also discussed that how we will be doing with two representative boards, one is with STM board and another is with Arduino board.

So, for both the boards we have to remember a few things that there are certain library functions which I have already discussed, those functions you have to include, if you do not include those functions it will not work. So, when you write the code you have to make sure that, you have already included those functions, the two functions are LCD display and LCD scroll we have already discussed all those things.

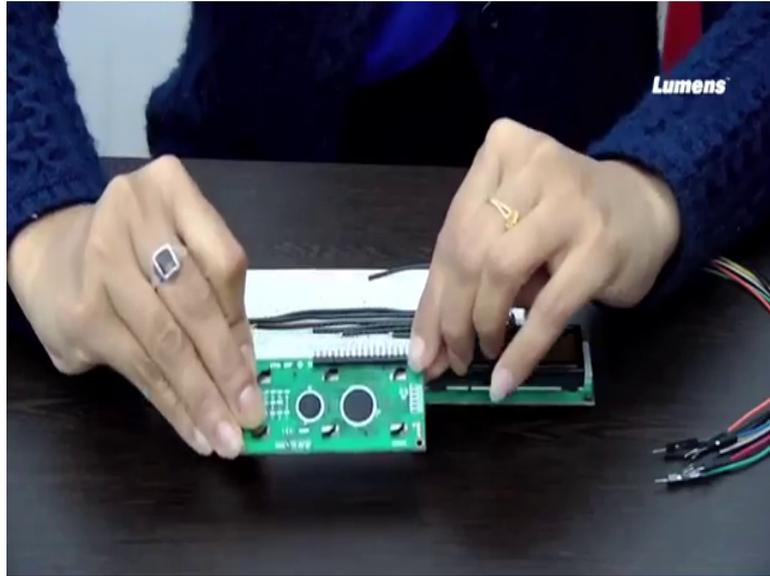
Now, I will directly come for the interfacing part; let us see how I will be interfacing this particular j h d 16 to a LCD ok.

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So, this is the LCD that we will now be interfacing, it has got 16 pins, starting from the first pin here then the next one like this.

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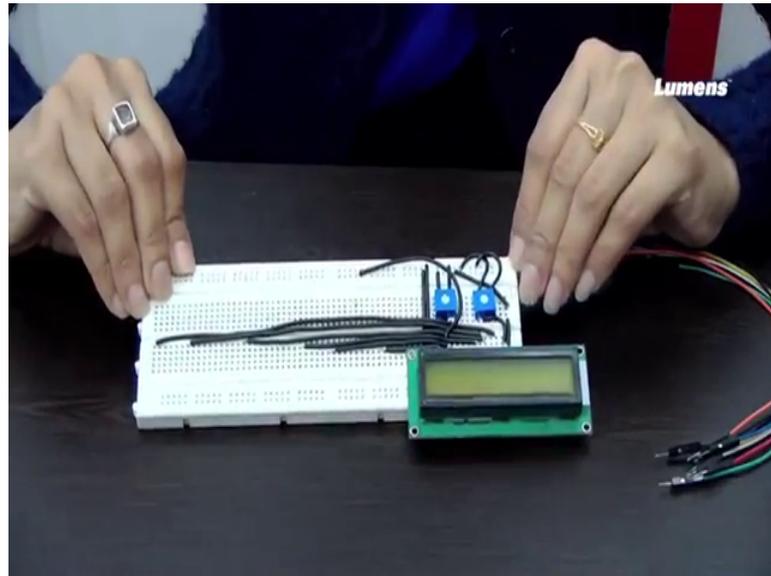
These are the pins basically. So, this particular pin is number 1, then 2 then 3 and so on till 16.

I have already discussed about all the pins, but let me very briefly tell that first pin will be connected with ground, the next pin will be connected with VCC that is 5 volt the next pin is the contrast one which we will be connecting using a potentiometer. So, for that potentiometer one end will be connected to VCC, another end will be connected to ground and from the third pin it will be connected to the middle point of the potentiometer.

The fourth pin is the register select which we will be connecting with the pin number d 13. Now this is how we have done the connection, let us say you want to change the connection and you want to connect it to any other pin you have the freedom of doing that as well. The next is read write which where, in this case we are only writing.

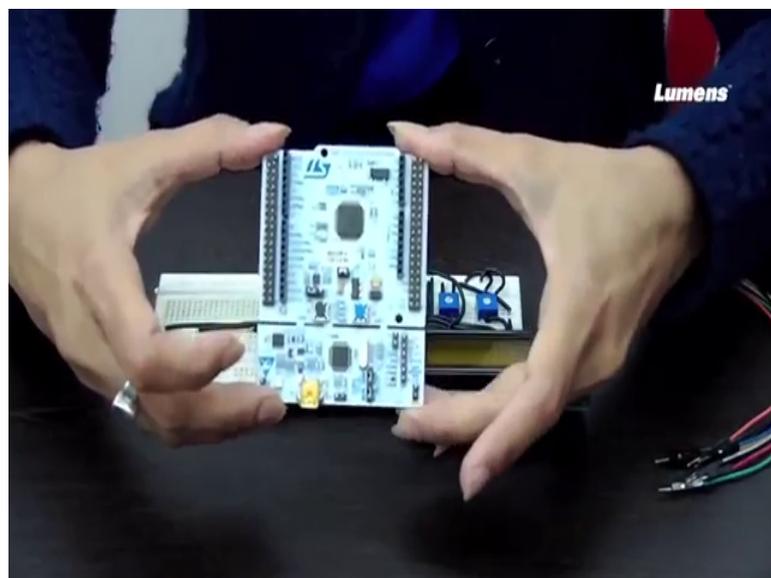
So, we have connected that to ground, the next pin is enable which is connected to d 12 and then the consecutive 4 bits that is dB 4 till dB 7 is connected through d 11, d 10, d 9 and d 8 of the of the pins of STM board. So, let us now see that how I will be interfacing this. So, these are the pins that we have to connect to the board pins of STM.

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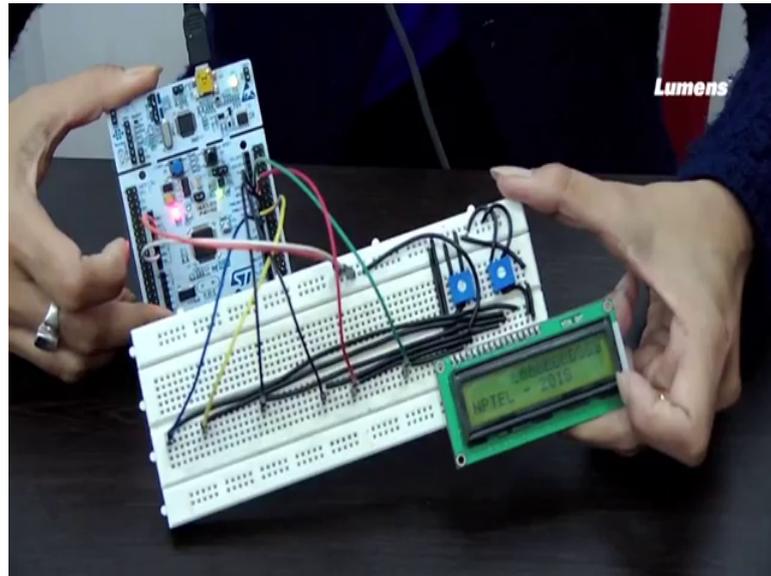
So, now I have already made this connection where this is the first pin. So, this is my ground, the first one I have already discussed about breadboard. So, this is connected with ground, first one this one is the ground and this one is VCC.

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So, as I said I will be first showing you with the STM board ok, with this board we will be doing the connection and you can already you already know about the pins of these boards. So, there are there is VCC ground and then there are other digital pins available in this particular board. So, now, I will be connecting it one by one, let us see how.

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So, let me first connect the first pin which is here to ground and that we connect this particular pin to ground and the other one to VCC so this these are the two common points. So, this one is first row is the ground next one is the VCC here, that we have connected.

As I said for the first one first line first pin of the LCD is connected with ground, the next pin is connected to VCC, the next pin is connected through this potentiometer you see we have connected this potentiometer and this potentiometer we have taken one end to VCC the other end to ground. And from the middle point it goes to the third pin, if you see from the middle point it is actually going to the third pin. Here if you see it is going to the third pin here ok.

Now, next one is register select which will be connected to d 13. So, here is my d 13 this is my d 13 which is connected to this fourth pin, which I have already connected through these wires initially. So, I am just connecting it, d 12 will be connected to read write end basically read write is directly connected to ground right. So, we will be connecting the next pin is the enable pin. So, the enable pin is basically connected with d 12 just look back into the connections that I have already discussed in the slides ok. So, it will make you clear.

So, this is how first this is d 3 which is register select and this is the enable pin and these 4 pins are basically the data pins, that is dB 4 to dB 7 ok. So, now, let me connect this dB

4 to dB 7 to d 11 d 11, d 12 d sorry 10, d 9 and d 8 ok. So, without any confusion I will just repeat the whole thing that I have done, please look into this carefully what exactly we have done.

We have connected all the pins of this LCD that is starting from pin 1 till pin 16 to various pins into this STM board and internally to ground VCC as and when it is required ok. Follow the circuit diagram that is already provided to you in the slide where we have given exactly which pin will be connected to which pin of this particular board ok.

So, for this connection this is ground, this is VCC that we have connected and we have connected the various pins that are required that is basically the register, select, enable and dB 4 to dB 7 in these places and internally there are other pins like your ground, VCC, contrast, read write and a anode and cathode to other places. One more thing we have done here this is basically to provide contrast such that this display becomes more clear, we have connected the anode that is the pin number 15 again to this potentiometer and we have adjusted accordingly. So, this end is connected to VCC the other end is connected to ground and from this point you see it is connected to the anode ok.

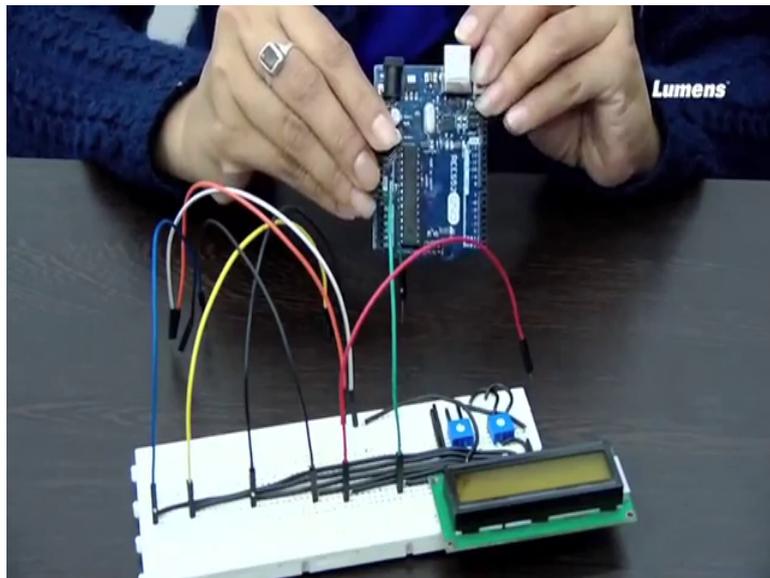
And cathode is directly connected to ground, this is all about the connection this is how if you want to make this at your end you require the following things, you require the following jumper wires, you require potentiometer, you require LCD and of course this board. Now what I will do the code that I have already written, I will be dumping it into this board, let us see, ok. Can you see this now what is getting displayed embedded system NPTEL 2018 ok. So, we have written these two text in the two lines of that LCD which is getting displayed here.

Now, I will simply change this text to some other text, let me see what happens then this character is exactly 16. So, it is getting displayed like this, but now I have entered a text which is embedded system design with r, can you see the scrolling text the first text is scrolling that is the number of characters in this entire text is more than 16 character. So, it is getting scroll, it you are getting a scrolling text, now this there is also one important thing you see the speed of this one. Here we have made in one second two characters will get displayed. Now we can also make that in one second 3 characters will get

displayed. Now we will see that, I will not be dumping the other code where you will see that suddenly it will change its speed, can you see this?

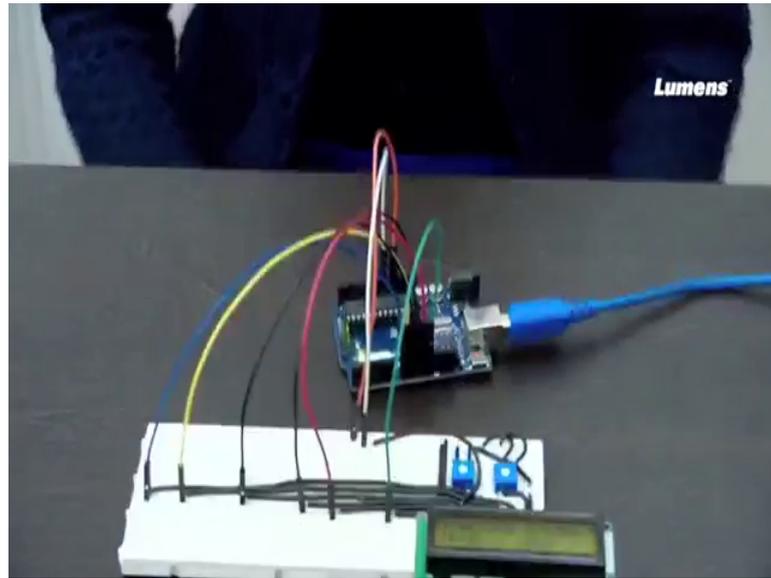
Now, you can see that it is going little faster as compared to the previous one. So, this is how you can make numerous variety of changes in this particular LCD, I would also like to show you now the connection with Arduino board. So, this is the connection with STM board ok. So, now, I will do the same thing with Arduino board.

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So, this is the Arduino board which I have already discussed in detail. So, now, I will be doing the same kind of connection.

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The ground I will be connecting to, connecting here the VCC I will be connecting here, and then the pins will be connected to the various pins of Arduino board.

So, here also we have made to connect from pin number 13 till 8. So, the same way I will make the connection. So, this is how I am making the connection ok. So, the same way we have connected from d 13 into d 8 rs enabled and dB 4, dB 5, dB 6 and dB 7 and others are already connected to VCC and ground. Now I will be showing you that how it works with Arduino, the code we have already seen how to make the code for Arduino. Now you see the code we have already dumped and now it is displaying embedded system NPTEL 2018, fine.

So, this is how you have to make the connection when you do with these boards ok. So, now, what we have done in this particular lab is that we have shown you how the LCD that is this j h d 16 to a will be connected using this STM board and how we will connect it with Arduino board this is all we have shown you in this particular experiment. But now what will be the use of this, next experiment we will be interfacing various sensors. Now that we have already shown you typically two or 3 display device like you one is this 7 segment and another is this LCD. Now we will be moving on with how do we interface various kinds of sensors ok

Now once we interface the sensors basically we are what we are essentially doing we will be getting some parameters from the environment and those parameters I need to

have the digital value displayed ok. So, you can either use 7 segments for your display or you can do it using this LCD. So, for all the experiments that we will be doing which requires something to be displayed we will be using these two output devices.

Thank you.