Indian Institute of Technology Kanpur

National Programme on Technology Enhanced Learning(NPTEL)

Course Title
Introduction to Experiments in Flight

Lecture -11
Data Acquisition using MEMS Devices

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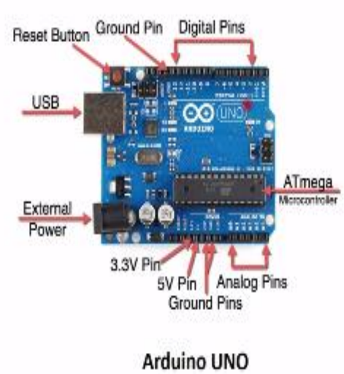

Hello friends so far we have learnt about various sensors and how they are used to calculate different parameters such as speed, your altitude, what maybe the pressure, your position and we saw the working principle of different sensors. Now today we will be using the sensor to acquire data and we will be doing this automobile.

Now this is a simple mode it has a at mega 3 to 8 feet macro controller, it has 14 digital pins, 6 of which are for P11 outputs it has 6 analog input pins. It has a flash memory cost 32 kilobyte and a clocks we have 16 mega hertz, now in order to acquire data for acceleration and rate guiders.

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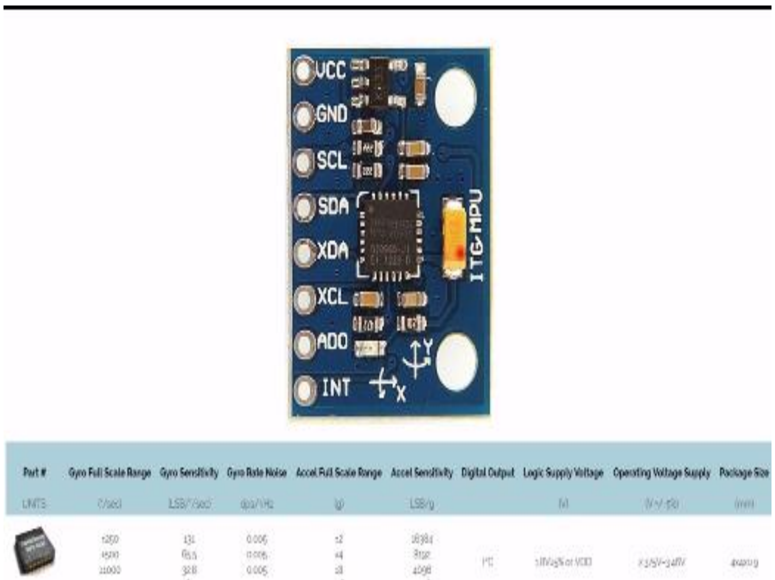

The sensor which we will be using is amplitude 6050 on this is amplitude 6050, it has X low meter and read the arrows. Now you can see the full detail of this sensor from datasheet and this is a summary of what we give the range and sensitivity of rate guiders and accelerometer what will be supplied voltage and size of this sensor. Now first part of this is to make connection in order to acquire data.

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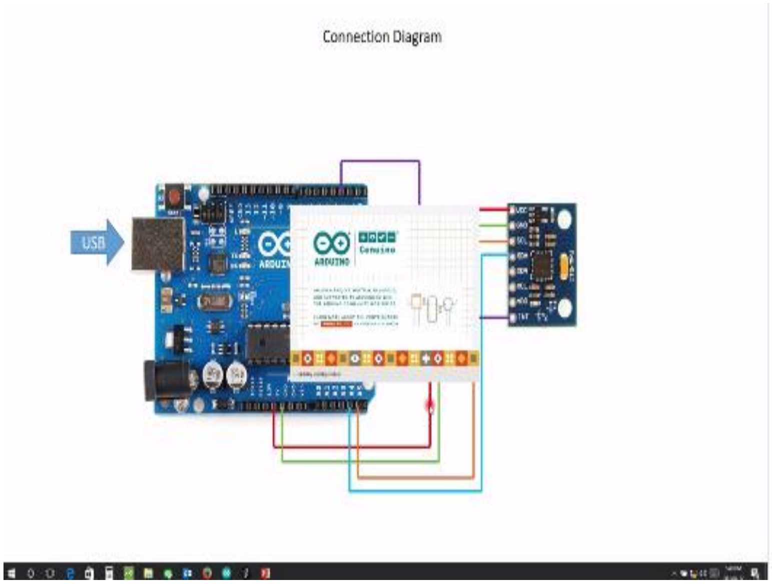

So simple connection between amplitude 6050 is we have to use, we have to see protocol and connection is as follow amplitude BCC will be connected to five volt of as you know, here the CL will be connected to the analog input k5, STO will be connected to analog input A4 and your interrupt signal will be connected to digital or foot pin.

Once this connection is made you can power or remove either using the USB or you can use next in pause light to pause the original IDE. Now in order to acquire data from sensor you have to use an ID or some platform to write code in this case we will be using original IDE, so just within original IDE.

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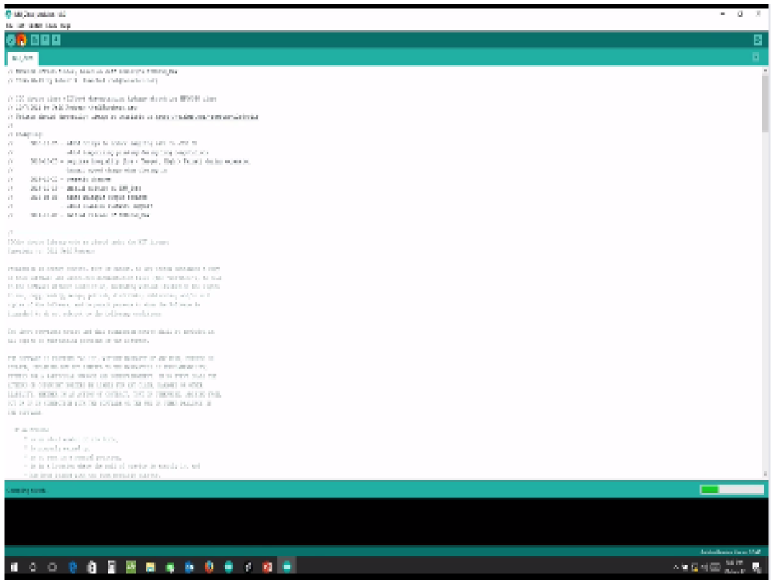

Original using USB and make sure that right compound is selected in my case it is count 6 now we will be seeing there are several examples already motioned in this ID will be taking some examples related to MP 6050 now before taking data from your sensor first step is to calibrate it or your know if the of set of this sensor so there is an inbuilt program in the example which is called as you can see as time 0 just you have to chick on that and program opens with this program is made by reef robot and it will calibrate the offset of your MP 6050.

We have to place your MP 6050 on the horizontal surface and first we will compile this code click on compilation it will compile and give if there are some errors in this code now complication is done then it shows there are errors once compilation is done we have to upload this code click upload once the code is uploaded click on upload.

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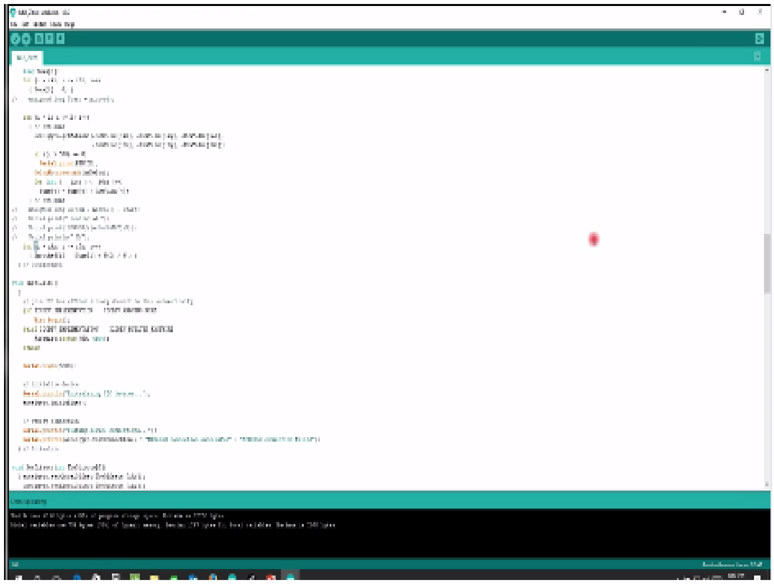

Once the code is uploaded click on second monitor.

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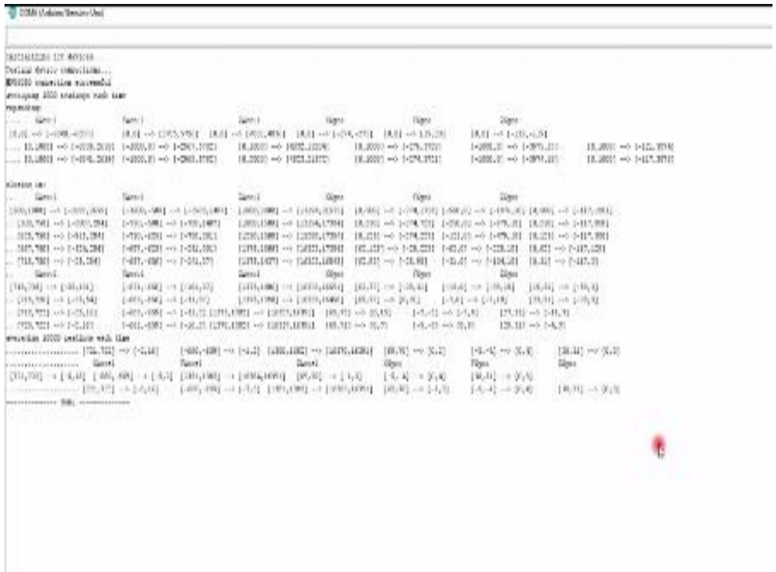

We had moderate was 9600 as you can see from code the data was 9600 prorate and it will check your timing device for offset it has two readings one lower value and higher value it will keep on decreasing this interval and give you an offset file then we have to wait for 3 to 4 minutes in order t calculate the right offset value for your sensor once calibration is done we will get the message done and the values for offset in acceleration will be 7 to 1 in y acceleration it will minus 660 in z acceleration it will be 1351 or gyro that offset will be 69 for gyro it will be - 5 and for z gyro it will be 30 not exactly these values somewhere in-between this dozen of set.

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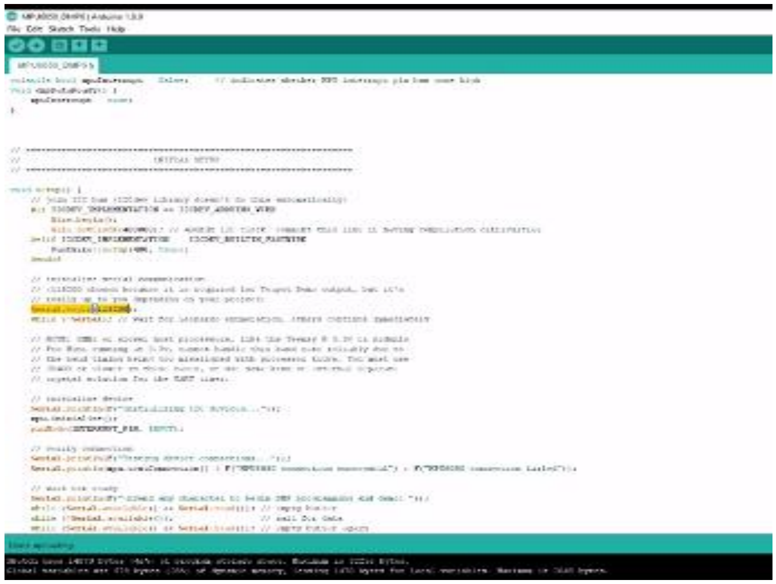

So once calibration is done we will go for other example and view 6050DNP6 now here this program calculate different values depending on which function you use here you have to enter this off set value in order to get correct reading so this is a court will be seeing output in trems of roll, pitch and York and offset value is we have to which we got from previous example will be given here.

Your X gyro in offset was 69 now Y gyro offset was -5 your Z gyro offset was 30 and Z acceleration of Z we got was 1381 once these values are set in offset then you have to click on compile here you can see here single begins is at 15 to 100 moderate so while seeing the output of serial monitor we will select moderate as 15 to 100 once compilation is done then you have to click upload. Once upload is done you have to click on serial monitors.

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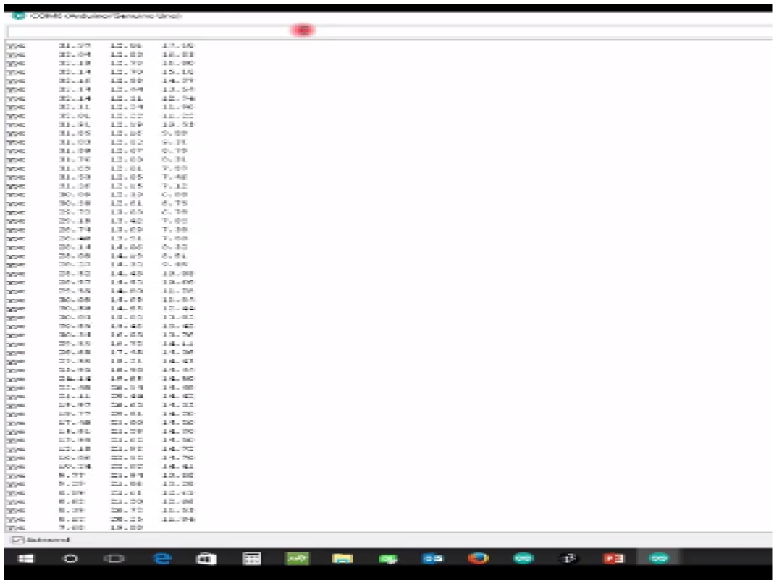

Select moderate as 15 to 100 it will ask you to enter any collector in order to start data streaming so this is your interrupts single here click on this bar and press any key and entre and these are the values of your pitch and roll and as you can see as I tilt my IMU these values will change. Now these are in terms of number we do not have actual feeling how your object is behaving just you can see that you are getting a your off -4 or 10 to 20 degrees your pitch 3 or 11 degrees.

And your role less 30, 20, 45 now the limitation of or you know RDE is that you do not have a graphics changing in order to see how graphically your timing is behaving you have to use another ID which is processing.

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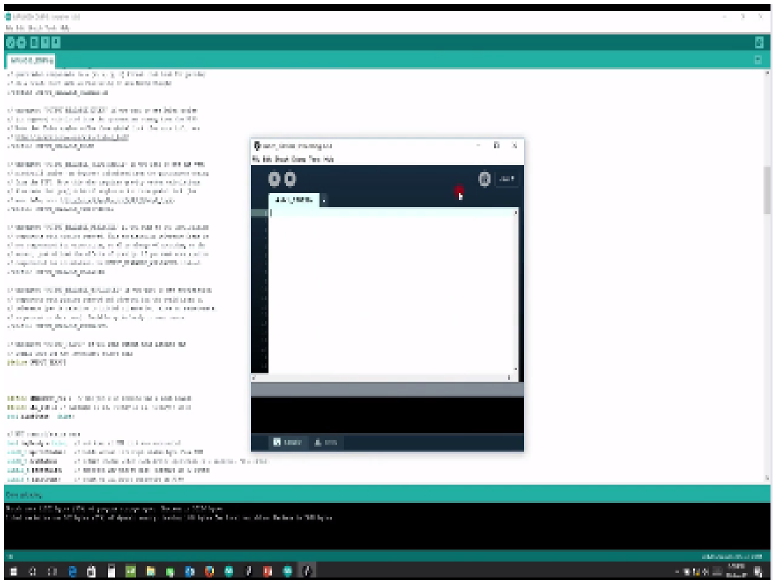

For that there is a small modification you have to do in the code MEMS 6050 DMP, now we was seeing output of readable your pitch and though we have to commend this value commend this function and you have to use output T pot once you have done this lift upload, once upload is done click on processing IDE now in order to run this program you might need some additional at theory.

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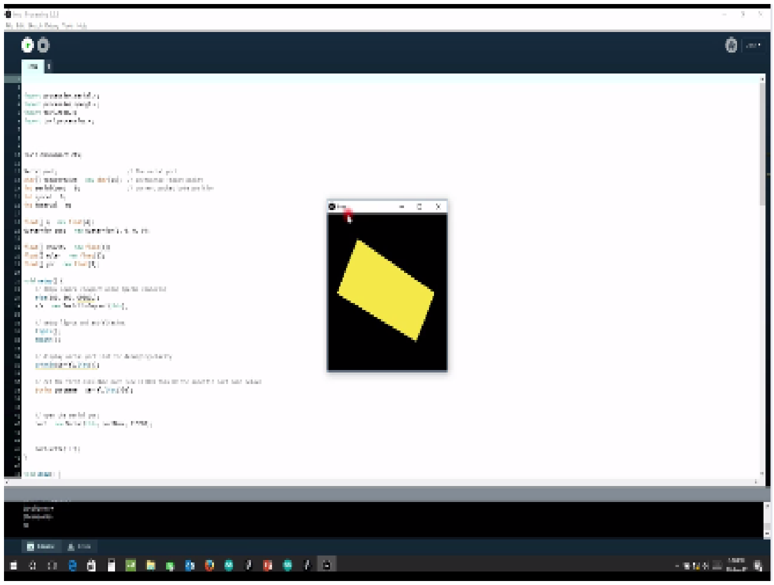

Once this processing is opened then there is a small code which we have written let us move IMU, IMU dot this is a small code it will show how your IMU is behaving and you can graphically see this because this IDE has graphic surging facility, so we have already done a code and if it is 6050 DMP 6 and we have set output as T pot once this is done just click on your code and this is a output you will get.

Now this you can see as you move your IMU this cuboids or box will move according to that so you can actually feel how your IMU is placed or you can visualize when this IMU is placed in some UAV or somebody which is rotating or moving how your IMU would be feeling acceleration and rates according to that, see. Now similar way we will see how to use angle of attack sensor to get data.

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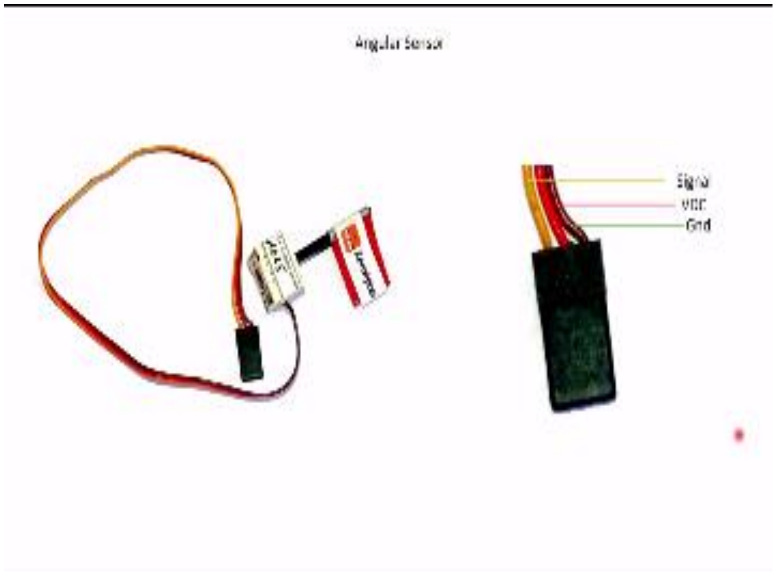

The second experiment is to occur data using angular sensor as you can see this is the angular sensor and it has a scholastic control upon rotating this control you will be getting different values these values can be done mapped according to your VDC voltage that is from 0 to particular medics you have to map this rotation, now once this particular mapping has been done then you will given further map these voltages corresponding to a particular rotation to 0 to 360^0. And as you can see in this sensor it is 3 wires now that is signal VDC and Gnd, now connection that has to made with RGNO board.

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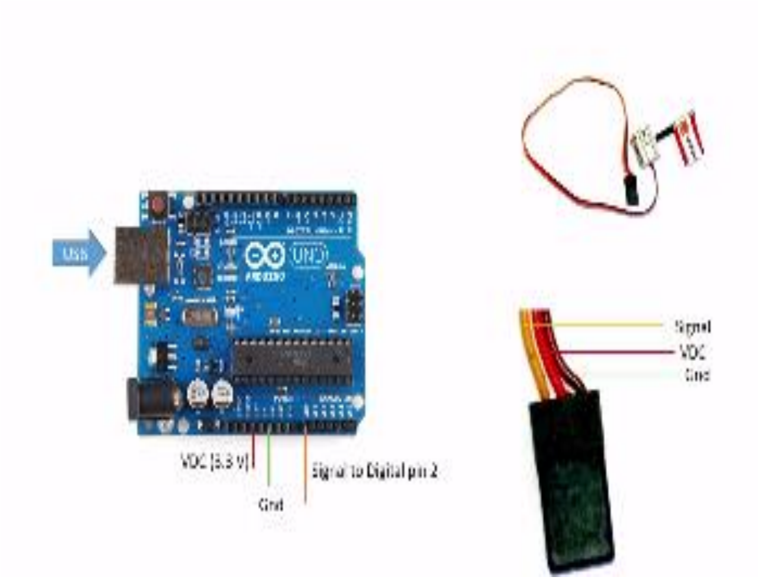

Is as follow this is signal been corresponding will be your analog input a knot and VDC will be 3.3 port and round will be connected to RGNO count board, after that we have to opened your RGNO IDE we have written a small cope for this sensor will explain you how this would works.

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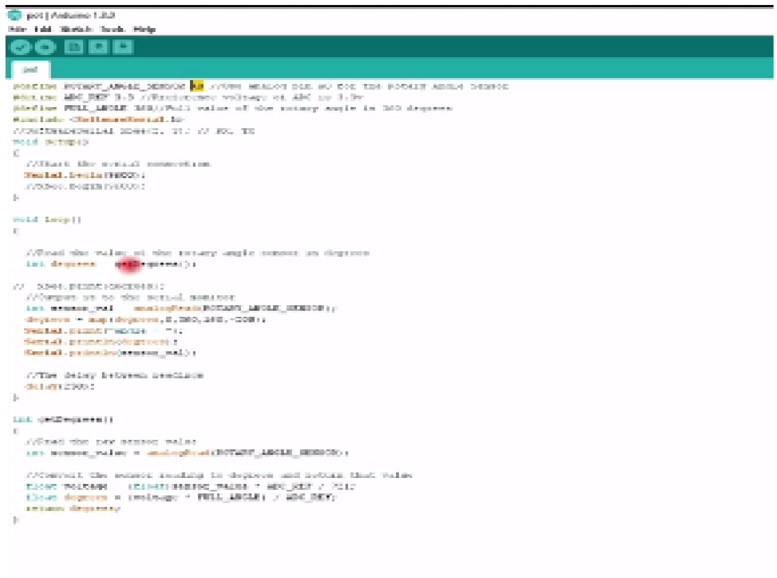

As you can see each code has two sections one is setup and second is where loop and further function can be defined in any of this loops now here in this code now first we have mention at what particular port of RGNO port will be taking done input some our sensor her we have given e note that is why we told you signal will been a note the system so there able you can change this analog input port.

Now reference voltage is 3.3 volts and full rotation of this rotator control is 360 million so analyze 360 now first in setup we have seen previous section also that what particular bought rate will be transmitting our strum data that has to mention in step setup. Here we are esteeming a 9600 bought rate, now second is your loop now in loop you can see we have use the function get degree get degree is nothing but here the sensor value you can see it is reading what is the value it is getting from input port E0.

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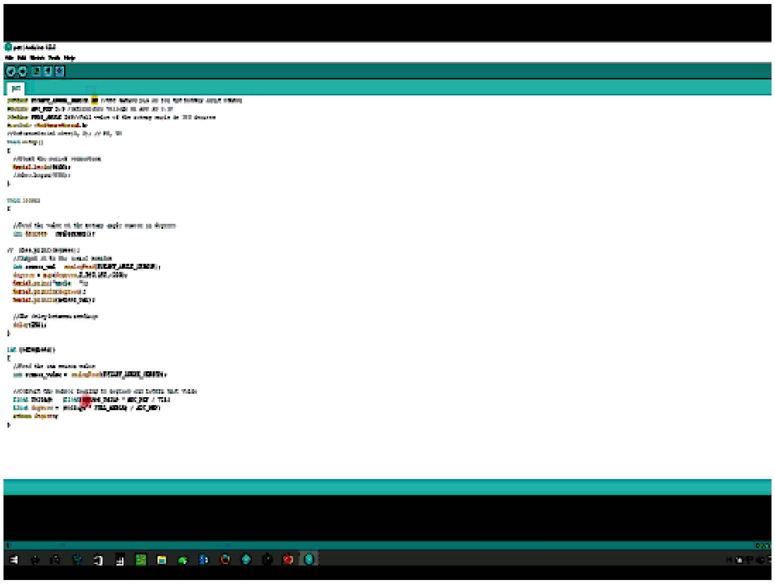

This value is then converted into voltages, using this relation. Now sensor, suppose is 4 values, where reference voltage is 3.3 and 721 is a maximum value which you are getting upon rotating this contact or control switch, or this rotatory contact. Once you get that value, you can then map this value to particular degree, using this particular set of equation, using this equation, this will further give you that degree.

And now if you want to set a reference point say, you want to fix this rotatary contact to a particular point that you have set as 0, so we have to first fix this rotatory contact to a particular position and then corresponding voltage that to get, will be then mapped in degrees that is 0 degree will then represent, that particular value and upon rotating in clock, anti clockwise it will either decrease or increase, in my case I mapped it in such a way that it anti clockwise rotation will increase my angle in positive and clock wise rotation will decrease my angle in negative and it can, it will go from -200 degrees to 160 degrees, total of 360 degrees.

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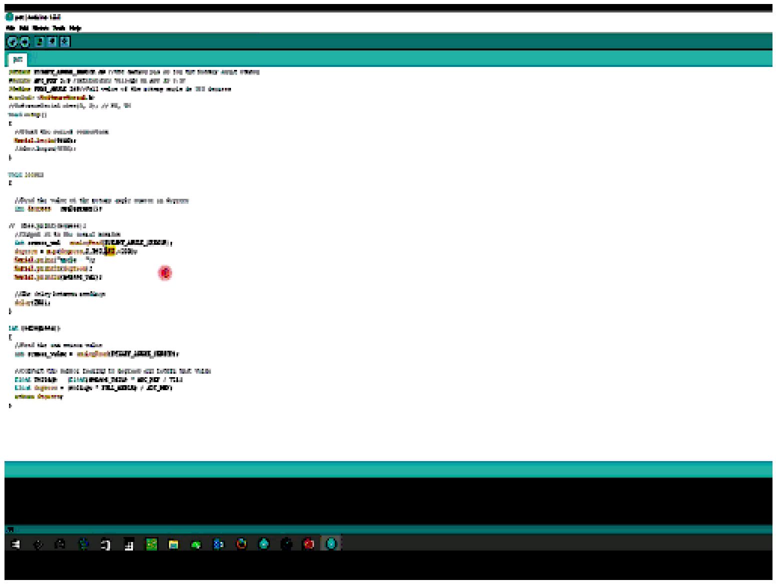

Now let us compile the program to switch if its error or not, now compiling them, we are not getting an error, now upload code, once a code is uploaded go to CL monitor, what rate you have to set corresponding to it we will be getting output, I told you first you have to set your reference point, I set my reference point to 0, to this particular point, this contact position. Now when I'm moving this rotatory contact in clock wise direction, you can see angle value increases, the number you are getting that is decreasing.

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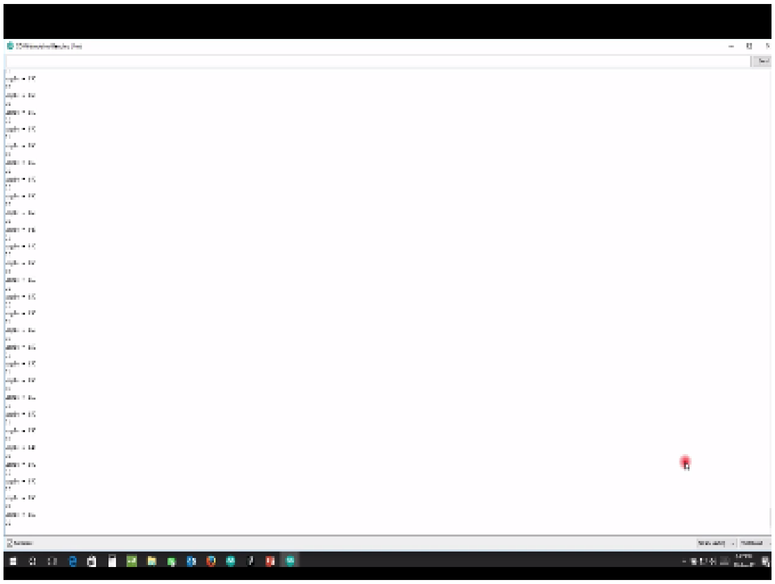

Which is understandable here the positive rotation will increase the value were as negative will decrease then value of rotator contact. Now I am rotating in clock wise direction and you can see my analysis decreasing and it will go beyond -2. See -197 after that it is proceeds to positive value.

So this way you can map a particular potential or rotation to corresponding rotation techniques there are lot of quotes available for adrenal platform and sensors are available. You can use that learn the quote and these are beneficial when you want to acquire data some equilibrium data or some instu or some platform where you want to analysis how it is behaving what it is done data is pitching angle so this will be beneficial for you. We will be sharing this code on the forum and you have any doubt you can ask them on forum.

And you can use these types of sensors to design in angle of tax sensors because when this will be aligned it will be the aircraft and as this flag will move or wind type. We have learned in previous lecture when hoe wind type angle of the taxes. When there are this angle of, when this wind move up and down corresponding to that your angle will be shown and you can design it for an angle of tax thank you.

<u>Acknowledgement</u>

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