**Structural Health Monitoring (SHM)**
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**Lecture - 70**
**SHM applied to BSLRP -Part 2**

Let us now see, what could be the set of improvements we can have in the new revised system.

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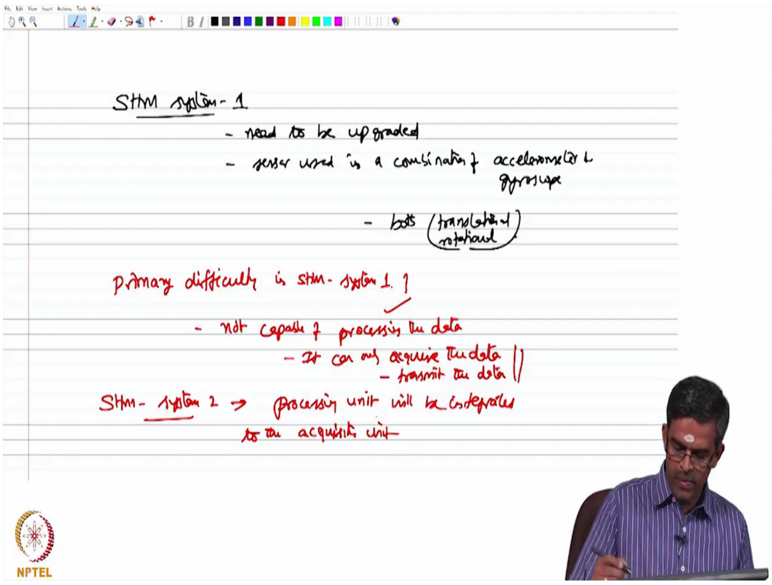


So, the SHM system 1 what we attempted so far and the result what we obtain need to be upgraded, because there are errors of the wireless compared to the wired ones. Now the sensor what we have used at present is a combination of accelerometer, and the gyroscope because we have measured the inclination as well because we have measured both translational and rotational.

So, let us see, what is the primary difficulty in the system design? What is the primary difficulty in let us say SHM system 1? What is the primary difficulty? The primary difficulty arises is that it is not capable of processing the data, it can only acquire the data because the delay in processing may be one of the reasons for the noise generation, of course, it can transmit the data, but we now need to improve the system design. So, that even the processing can also be done in the sensor itself ok.

Therefore, a new system which is SHM system 2 should be try or is proposed now in which processing unit will be integrated to the acquisition unit of the sensor the change is now desired.

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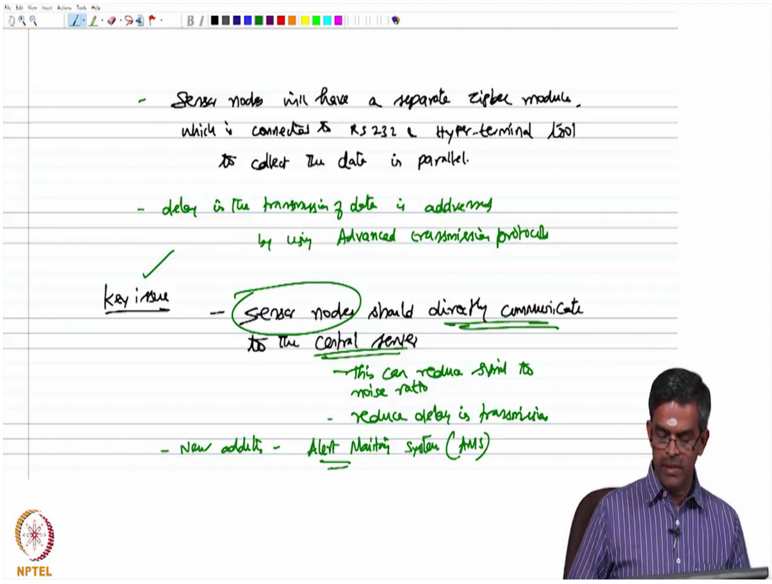


So, now the sensor nodes will have a separate zigbee module which is connected to RS 232 and hyper terminal tool to collect the data in parallel. So, now, delay in the transmission data is addressed by using advanced transmission protocol.

So, the key issue here is sensor nodes should directly communicate to the central server that is what the desired requirement is. Now this can reduce signal to noise ratio and it can reduce delay in transmission. So, the desired issue is now going to be sensor nodes should directly communicate to the server. Further, a new addition is also done in the SHM 2 which is the alert monitoring system, not only the health monitoring, but alert monitoring system is also now added to the design.

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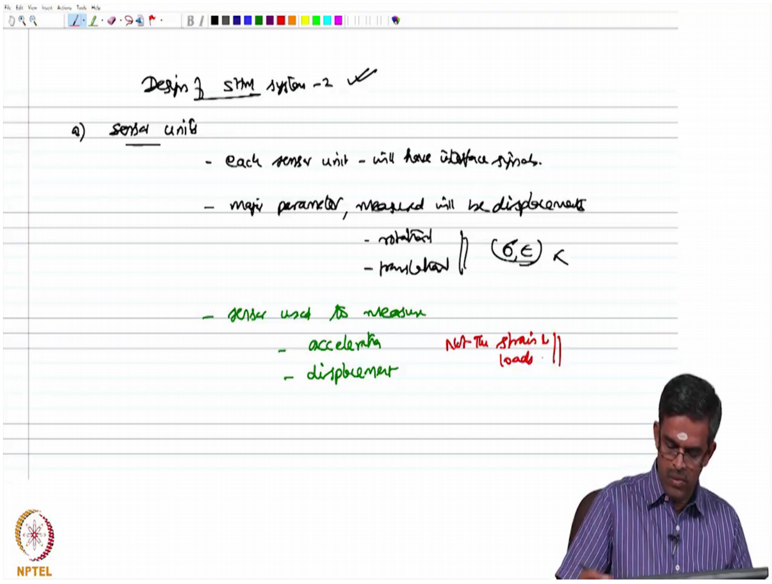

Let us talk about the design of structural health monitoring system 2. So, let us first talk about the sensor units. Friends, we are really understood why the design 2 is essential because design 1 does not compare very well with the wired sensor acquisition, there is a 30 percent error, qualitatively it is fine, but there are some issues related to data transmission, data processing, etcetera. We are now attempting to design a system which is going to overcome these difficulties.

So, that whatever we acquire through wire should exactly match with that of the wired sensors ok. So, let us talk about the sensor units. Now each sensory unit will have interface signals, the major parameter study or measured will be displacements both rotational and translational, we are not talking about the stress and strain measurements here. Therefore, sensor used or recommended in a system, system 2 will be to measure acceleration and displacement definitely not the strain and the loads ok.

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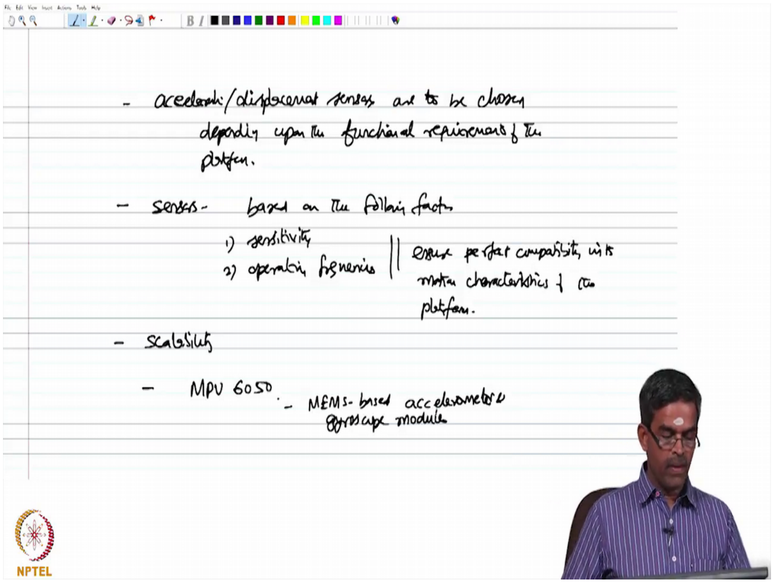


Now, the acceleration and displacement sensors are to be chosen depending upon the functional requirements of the platform, is it not? Sensors will be selected based on the following factors one sensitivity two operating frequencies.

So, that they ensure a perfect compatibility with the motion characteristics of the platform, the other issue we want is the scalability. Scalability is also required. So, the sensor adopted will be in this case is MPU 6050 which consists of MEMS based accelerometer and gyroscope module.

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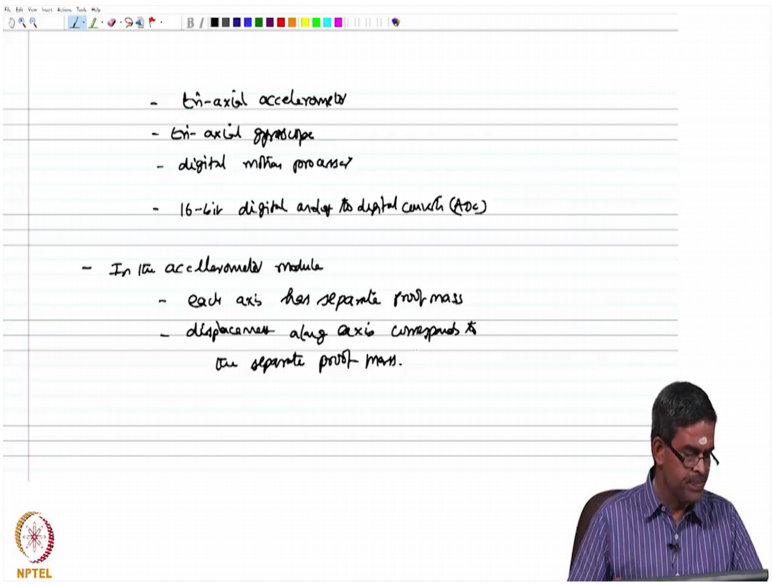

It comprises of tri axial accelerometer, tri axial gyroscope and your digital motion processor, it also has x 16 bit digital analog to digital converters that is ADC for digitizing the output received from the accelerometers and the inclinometers. Now, in the accelerometer module, each axis has separate proof mass while displacement along each axis corresponds to the separate proof mass in the respective axis.

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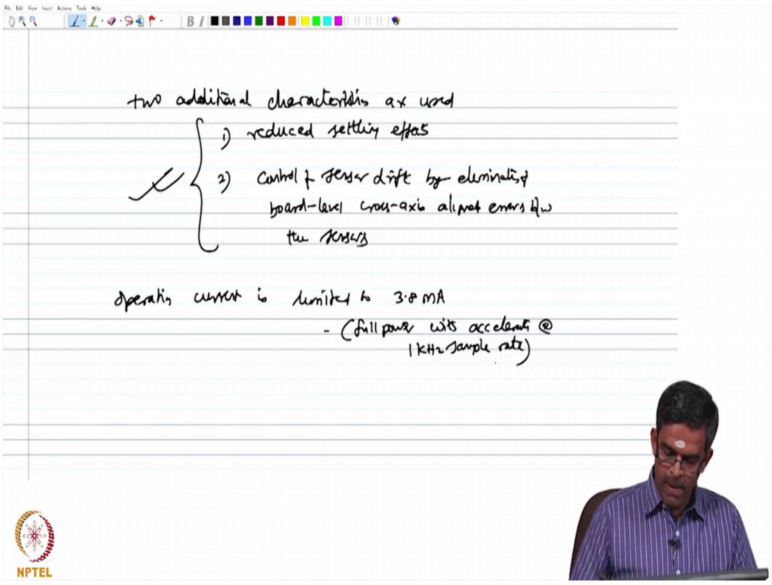


There are two additional characteristics which are important in selecting the sensor are also used. The first one is sensor should have reduced settling effects, further control of sensor drift by elimination of board level cross accelerometer cross axis aligned errors between the sensors. So, these are the two additional requirements which we look forward when we select the MEMS accelerometer and the gyroscope, the operating current of the sensor is limited to 3.8 milliamps. Whereas, the full power with accelerometer can operate at 1 kilohertz sample rate; that is a capacity of this accelerometer.

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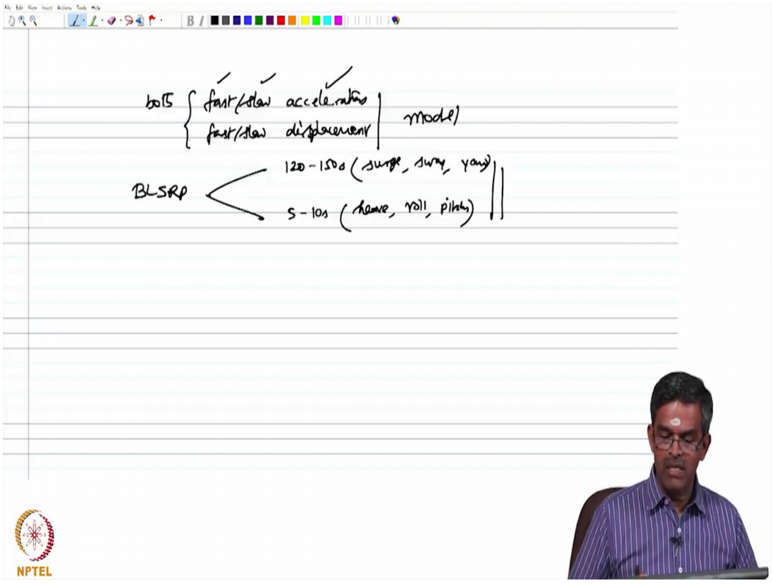


So, interestingly, both fast and slow accelerations; fast and slow displacements will occur in the model. I will tell you why BLSRP has two broad bands of frequency or their periods; one period vary from 120 to 150 seconds which is very very high at such sway and some extent yaw degree. Whereas, 5 to about 10 seconds will happen in heave roll and pitch degrees of freedom.

So, it has got a 2 wide band. So that sometimes the accelerations can be much faster or much slower.

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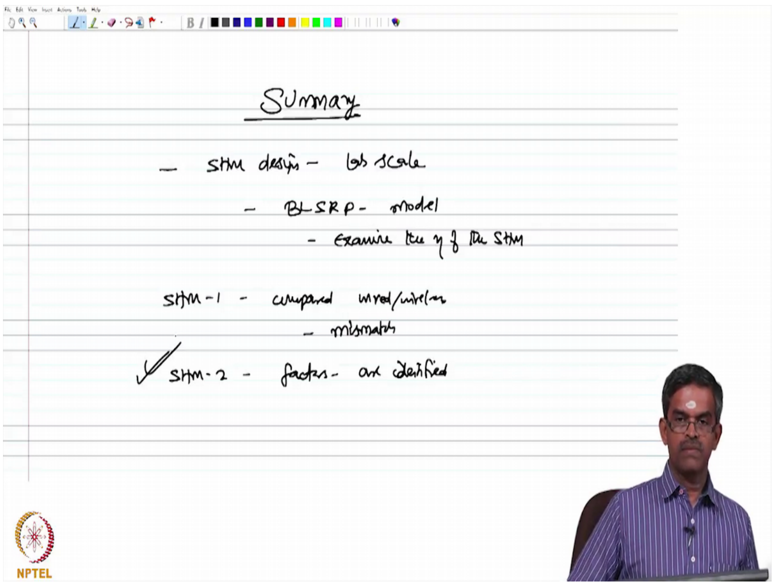

So, we are looking forward for a sensor which can measure both kinds, or varieties of the displacements and ok. So, friends, let us look at the summary, what we have seen in this lecture? We are looking forward for a structural health monitoring design on a lab scale, we have taken the buoyant leg storage and regasification platform as a physical model to examine the efficiency of the structural health monitoring system. We designed system one, we compared the results of wired with wireless, and we found to be that there are many mismatch and discrepancies. We started approaching to system design two where the factors necessary for improving are identified, and we are in the process of applying this and doing the measurements for BLSRP using the new system two, which we will continue in the next lecture.

Thank you very much and bye.