Structural Health Monitoring (SHM)
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Lecture – 68
Design of sensor layout for SHM -Part 2

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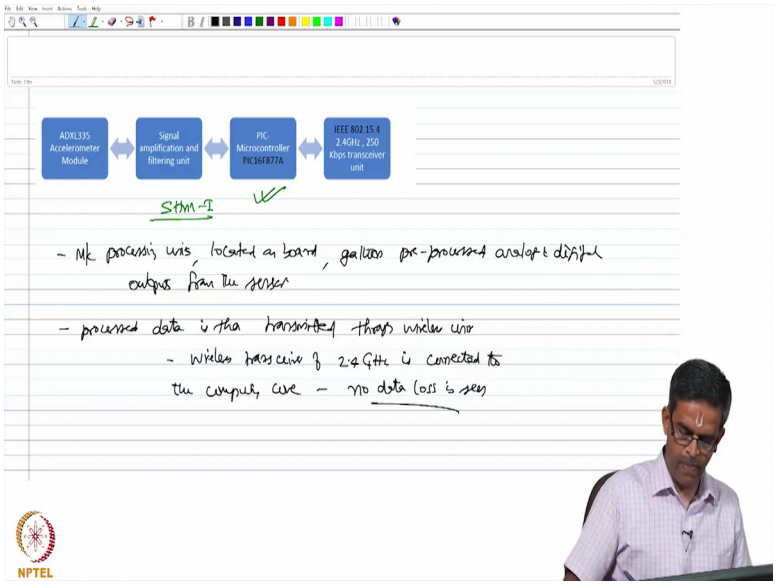

That is the layout what we discussed of SHM 1, we are talking about the specifications of the micro controller, the micro processing units located on board, gathers pre processed analog and digital outputs, from the sensor. The process to data is then transmitted through wireless unit the wireless unit, or wireless transceiver of 2.4 gigahertz is connected to the computing core directly.

So, that no data loss is seen.

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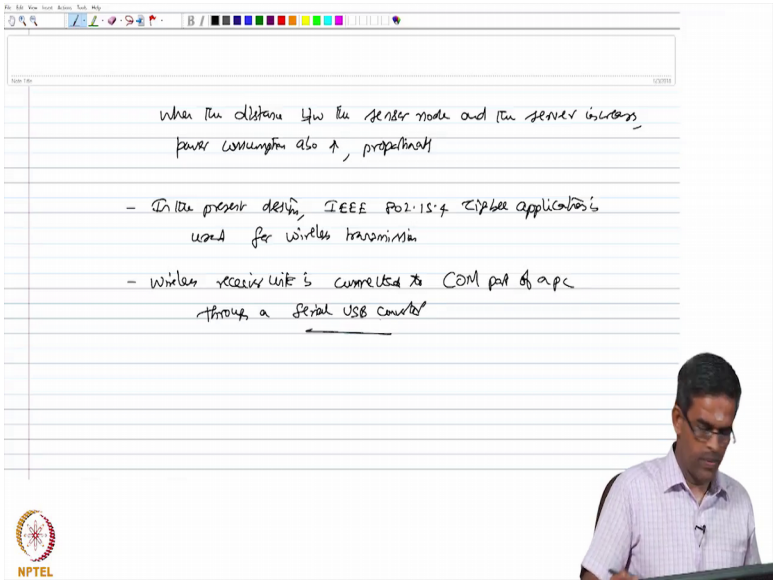

When the distance between the sensor and the server increases as in the case of this particular example, power consumption also increases proportionately; Therefore, in the present design IEEE 802.15.4 Zigbee application is used for wireless transmission. The wireless receiver unit is connected to the COM pot of the PC through a serial USB converter.

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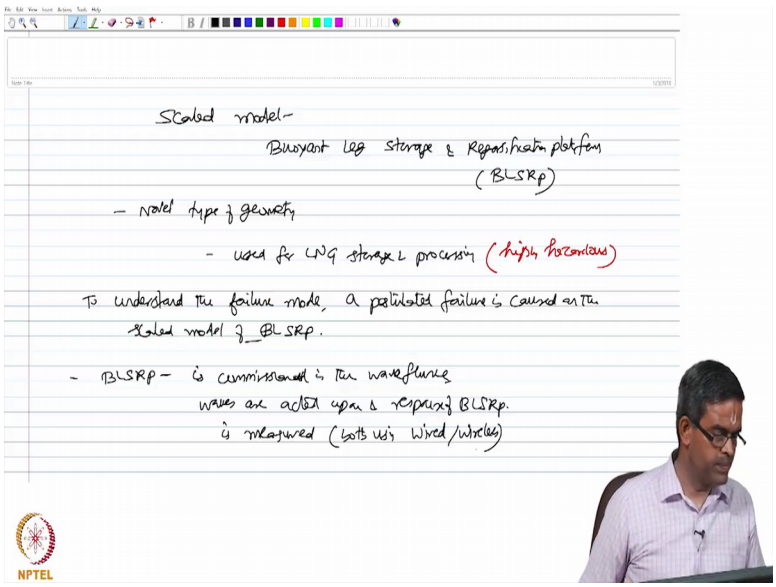

Now, the scaled model being examined is buoyant leg storage and regasification platform abbreviated as BLSRP, which is a novel type of geometry which is essentially used for

LNG storage and processing, you have to remember that LNG storage and processing is highly hazardous. So, health monitoring using wireless networking ultimately will be the most efficient tool, which is going to be a continuous, autonomous, unmanned monitoring, system ok. So, to understand the failure mode a postulated failure is caused, on the scaled model of BLSRP.

Now, BLSRP is commissioned in the waveflume, waves are acted upon and the response of BLSRP is measured, both using wired and wireless.

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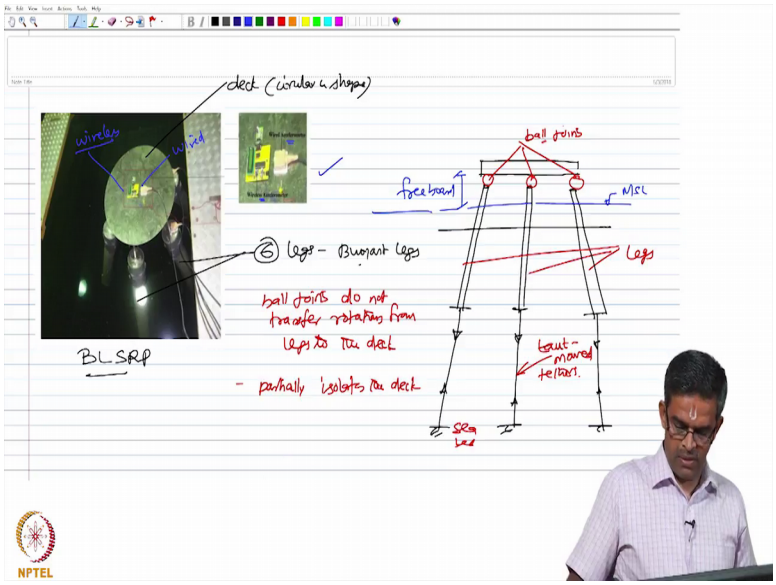

Interestingly the platform, what you see here in the picture is the BLSRP it consists of a deck, which is circular in nature. It consists of 6 legs which are called the buoyant legs, interestingly the deck is connected to the buoyant legs, which are in turn taut move to the seabed and they are connected to the deck using ball joints.

Now, interestingly these ball joints do not transfer rotations from the legs to the deck. So, it partially isolates the deck, these are the buoyant legs, these are taut moved tethers meaning, they have high initial pretension and this is the seabed in the model. So, this is my water level, which is my mean sea level and the deck is much above water and that is the free board we have. So, the adjacent picture shows you the location of wired sensors which is an accelerometer and, wireless accelerometer both located on the deck, you can see here this is my wired sensor setup and this is my wireless.

So, please note I am measuring the response of the platform, using both set of sensors simultaneously ok, one is wired and, one is wireless. We are going to compare the performance of these so, that the network can be decided as far as saturation is concerned ok.

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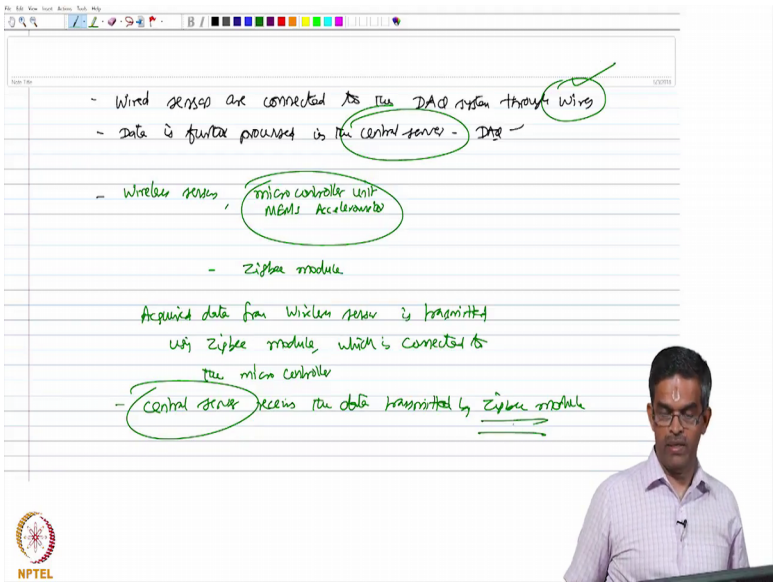

Now, the wired sensors are connected to the data acquisition system, through wires ok. The data is further processed in the central server, which is connected to the data acquisition system whereas, the wireless sensors which comprised of a microcontroller unit and, a MEMS accelerometer, or connected to the microcontroller using Zigbee module.

The acquired data from the wireless sensor is transmitted using Zigbee module, which is connected to the microcontroller. Therefore, the central server receives the data transmitted by the Zigbee module. So, in both the cases the measured data reaches the central server one through wires and, one through Zigbee module, which is wireless having said this.

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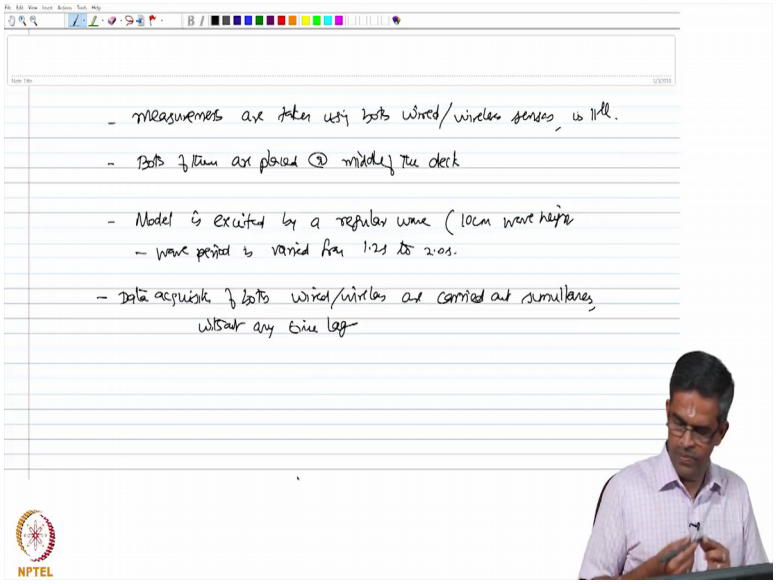

Measurements are made using both wired and wireless sensors correct simultaneously. Both of them are located at the center of the deck. Now, the model is excited by a regular wave of 10 centimeter wave height, the wave period is vary from 1.2 seconds to 2.0 seconds, the data acquisition of both wired and wireless are carried out simultaneously, without any time delay.

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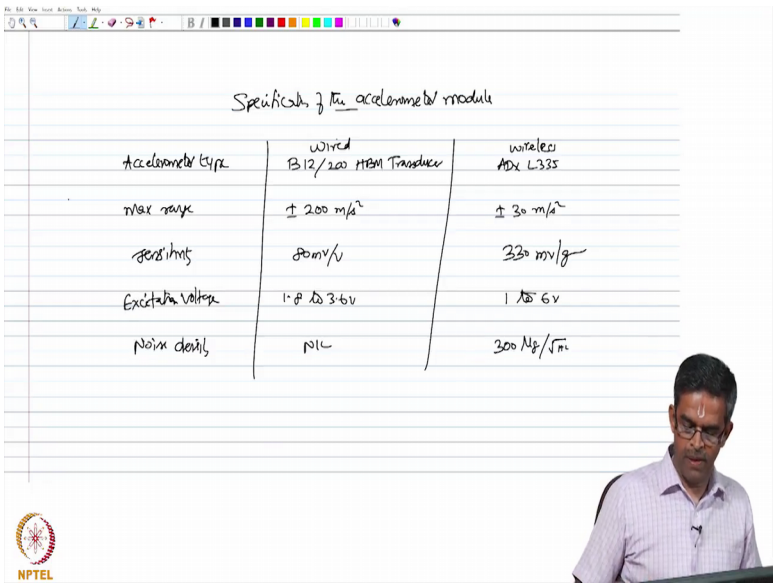

Let us look at the specifications of the acceleration module, being used in the study, the accelerometer type used in wire is B 12 200 HBM transducer whereas, in wireless it is ADXL 335.

The maximum range, which it can operate is plus or minus 200 meter per second square, this is plus or minus 30 meter per second square, sensitivity is about 80 millivolt per volt, this is about 330 millivolt or gram. The excitation voltage for operation is about 1.8 to 3.6 volts whereas, this requires slightly an higher power 1 to 6 volts.

The noise density of course, in wired is practically nil whereas, in this case it is 300 milligram per hertz. So, this comparison will give an idea of a variety of specification, which are actually used for acquiring the data in both the cases of the design 1 is wired and other is wireless, which are happening parallelly in the system.

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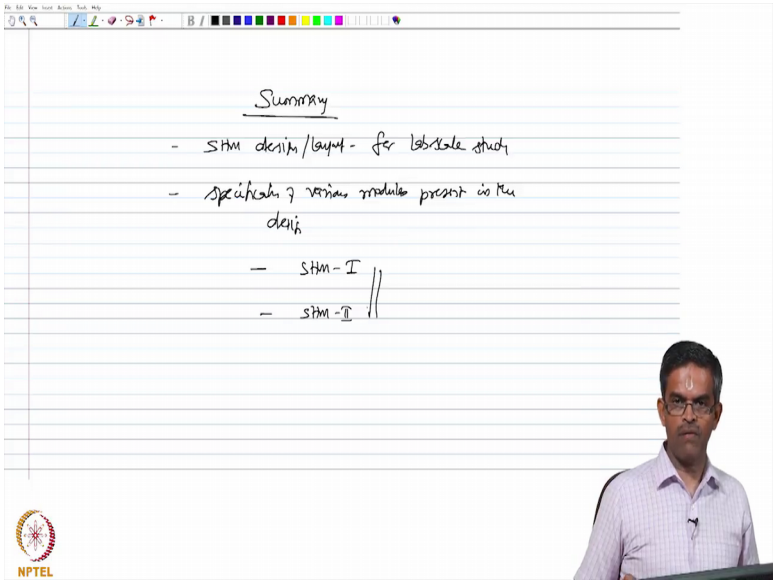

So, friends in this lecture we started introducing the structural health monitoring design and, layout for a lab scale study, we are in the process of discussing detailed specifications of various modules, present in the design.

So, we are now having two modules which is SHM design 1 and, SHM design 2 which are going to compare after, we measure the responses using both wired and wireless sensors. You look forward please for the next lecture of series, which will talk about the experimental results and, then the comparison and the pitfalls of the proposed to design

of a system layout and, then how it has been improved. We will discuss these details in the coming lecture.

Thank you very much and bye.