

STEPCONE 2020

Jan. 31 – Feb. 02, 2019

INDUSTRY DEFINED PROBLEMS

Problem 1: Smart Hat

Ensuring every worker's safety

Introduction:



With construction projects becoming larger and more technically diverse, we as an industry require to keep our workforce safe and healthy at all times. Current health and safety procedures are educational and reactive at best. The availability of real-time worker positioning data throughout a working day would ensure that alerts and responses are instantaneous. Health and well-being monitoring will allow us to be proactive in caring for the workforce; by allowing intervention before an incident occurs thus preventing rather than reacting.

Question- Design the Smart Hat which offers

- | | | |
|--------------------------------|---|--|
| 🔴 Heart Rate Monitor | ➡ | ☑ Measure exertion levels |
| 🔴 GPS Location | | ☑ Realtime Health and Wellbeing Monitoring |
| 🔴 Accelerometer | | ☑ Accurate Location Tracking |
| 🔴 Time and Attendance Tracking | | ☑ Determine Physical Position |
| 🔴 Bluetooth/WiFi | | ☑ Timesheet Generation |
| 🔴 3G Connection | | ☑ Safety Warnings |
| 🔴 NFC | | ☑ Automated Fire Register |
| 🔴 Rechargeable (Solar/Wired) | | ☑ Productivity Metrics |
| | | ☑ Access Control |
| | | ☑ No Additional Infrastructure |

Hardware:

Heart Rate Monitor

GPS

Clock

NFC

3G Connectivity

Accelerometer

Rechargeable battery

Bluetooth Device pairing

Solar trickle charging

Software:

Android/Apple App – Pairing to phones

Central collation database server and communication via 3G network or WiFi

Web Interface to monitor workforce

Problem 2 and 3: Water conservation & Sewage

Introduction:



**Conserve
water
Conserve
life**

is facing water scarcity problem for utilisation. In order to resolve this running problem, we need to think of the best implementable pure water conserving techniques. One of the techniques for

conserving water treatment of waste water for which we have sewage treatment plants. In sewage treatment plant water is treated with some chemicals after which it is ready to use.

Problem 2: Water is now getting scarce.

Question- Conservation of water in thermal power plants ? Come up with your ideas or projects for saving water.

Problem 3: Discolour water issue from Sewage Treatment Plant.

Question- How to improve the water quality (colourless water) from Sewage treatment Plant?

Problem 4: IoT is the present emerging technology

Introduction:



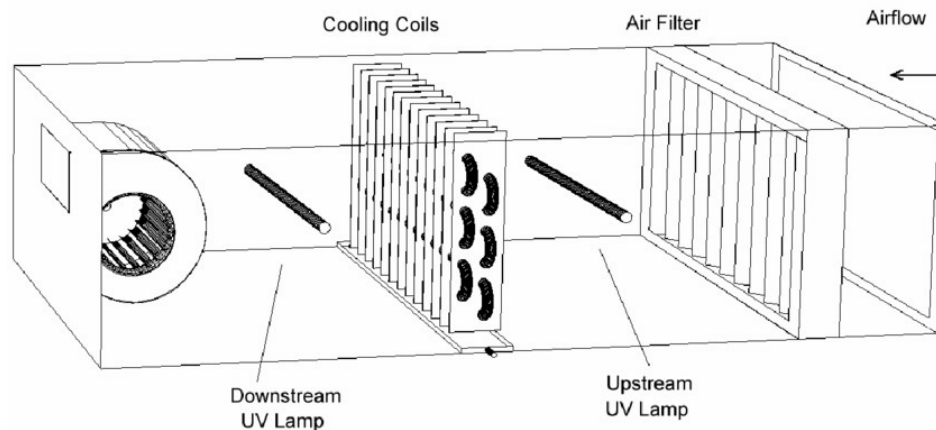
Every day we are hearing more and more about the internet of things (IoT), the next generation of the internet, but what exactly does it mean? Essentially, the internet of things is the interconnection of everyday devices to the

internet. We have to make it beneficial to the common man.

Question- Propose Ideas for using IoT/AI for the maintenance practices?

Problem 5: Procedure/technology/equipment to remove the dust which is accumulated inside the AHU?

Introduction:



AHU(Air handling unit) circulates air as part of heating, ventilating and air conditioning system. The basic function of AHU is to take-in outside air, re-condition it and supply fresh air. In order to kill microbes like bacteria, fungi etc., from the taken air, UV lamps are installed in AHU. But it doesn't completely serve the purpose because it doesn't clear the dust particles. The major problem is accumulation of dust inside AHU this will cause the UV lamp as well as the AHU to work at reduced efficiency.

Question- Suggest an procedure/technology/equipment to remove the dust which is accumulated inside the AHU?

Problem 6: No margin in ID fan for maintaining draft during firing of low CV High Ash coal

Introduction:



Induced draft fan is normally located at the outlet takes in the hot flue gases from the boiler through dust collector and delivers it to chimney. The quality of coal also implies percentage of Ash. The change in coal quality directly affects the coal consumption of the unit. Coal quality also affects boiler efficiency.

A coal with lower CV(calorific value) means high coal flow. More coal flow means more volume of air to be handled by the ID Fan, which ultimately affects the power consumption from the ID Fans. The maximum required range of speed that is designed for the ID fan is called margin of speed (here). When the low CV coal is used the amount of ash produced is more for which we require to maintain the margin of ID fans to clear the ash. The presence of ash stops the next load of coal which occurs due to no margin of ID fans. The coal given to the plant directly affects the generation.

Question- Make an economical solution to maintain the margin of speed in ID Fans to reduce the generation loss?

Consequence: Generation loss.

Cause: Lower Design/operating margin of ID Fan.

Problem 7: Fly ash ingress through suction causing high erosion of PA fan blades

Introduction:



The main function of the Primary air fan (PA) fan is to carry the pulverized coal to the furnace as fuel for combustion. This process is used to create the steam that is the primary process in the thermal power plant. In power plants, the PA fans supply air for conveying of the pulverized coal from coal mills to the furnace area. These primary air fans produce a high pressure to push the coal and air mixture through pulveriser into the furnace. The most common damage occurred in the power plant is fan failure due to erosion which is responsible for serious and costly maintenance. The rate of erosion depends upon the flue gas / suspended particles.

Question- Make an economical solution to protect the PA fan blades from erosion to reduce generation loss and maintenance cost.

Consequence: Generation loss and increased maintenance cost.

Cause: Fly Ash ingress through suction causing high erosion of Blades and inferior performance of blade.

Problem 8: Fly Ash conveying problem when Coal consumption exceeds 250T/H

Introduction:

In the plant after the coal is burnt we get fly ash which is a light coal dust. The disposal of Fly ash in this process is important. The amount of ash produced directly depends upon the amount to coal burnt in the boiler. Again for normal operation, as the rate at which ash is produced, it should be disposed at the same rate. But at some conditions, when the coal consumption increases, i.e., more than 250 Tonnes/ hour, it is observed that the ash disposal system posing problem like clogging, blasting of pipes due to increased pressure, etc... and hence resulting in generation loss.

Question- Suggest a solution so that there would be no generation loss assuming the coal has low calorific value.

Consequence: Generation loss.

Cause: Lower tolerance margin of Ash conveying system.

Problem 9: No margin for Super heater steam temp., control

Introduction:

To get better efficiency and also to prevent unnecessary material and thermal stress in thick walled components of boiler and turbine, it is very important to precisely control steam temperature on utility boiler. To get best possible heat rate to reduce fuel costs operators tries to maintain steam temperature at the rated value. By adjusting the amount of spray water in to the steam heater after it pass through a stage of super-heater (SH) it is possible theoretically to control superheat temperature control. However, on account of *boiler design deficiency*, it is very difficult to maintain the temperature precisely under the specified margins. As a result, there is a high heat rate and main stream temperature rise leading to boiler instability.

Question- Propose a suitable solution by making changes to the boiler design keeping efficiency in mind.

Consequence: High SH spray requirement in normal operations resulting high heat rate and MS temp rise during boiler instability.

Cause: Boiler Design deficiency.

Problem 10: In HP heater, leakages are observed after commissioning and consequently 22.89% tubes are plugged which is leading to further tube failure

Introduction:

High pressure heater is a kind of heat exchanger that has utilized to feed water pre-heater before boiler in Rankine cycle. In HP heater, there are several problems and one such problem is leakages from tubes even after **commissioning** (testing the HP heater before using in the industries like air leakage test, hydro testing of boiler, etc...) and this is the reason for tubes to be plugged. Plugging is a general practise that the tubes are out of service to prevent the rupture failure at thinnest locations of the tube. This problems is not only disturbing the overall process, but also decreasing the power plant overall efficiency overtime.

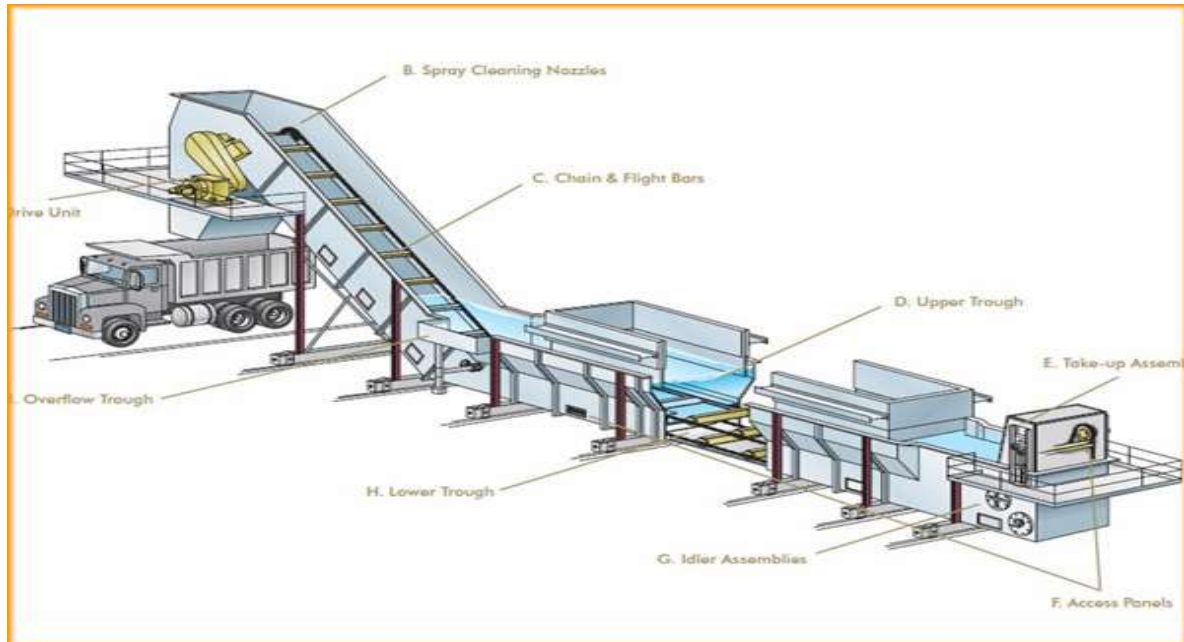
Question- Give a solution which stops the further tube failure.

Consequence: Potential threat for water ingress and loss in efficiency.

Cause: Commissioning issue which cannot be modified now.

Problem 11: Frequent failure of Submersible Scraper Conveyor Bottom Ash System

Introduction:



The Submerged Scraper Conveyor (SSC) is a device that continuously removes bottom ash from under the furnace of steam generators. Ash enters the SSC through the bottom throat of the furnace (or is discharged from a grate) into a water-filled trough. The SSC contains various critical components such as (a) horizontal trough, which consists of the wet (water bath) and dry section; (b) dewatering slope; (c) chain and scraper (flight) system; (d) head (drive) and tail (take-up) sprockets; and (e) Idlers to guide the chain. Due to failure in any of the component, it leads to failure in the operation of SSC, which eventually leads to generation loss.

Question- what can be done so that there would be no failure of components in the submerged scraper assuming we do not have any standby ?

Consequence: Generation loss.

Cause: Premature failure of critical component and unavailability of stand by SSC.

Problem 12: High vibration of ID Fans.

Introduction:

Induced fans are located at the outlet between dust collector and chimney. ID fans have impellers used for their design. Impellers are rotating devices designed to alter the flow of pressure of liquids, gases, and vapours. Impellers consist of various vanes — often blade-shaped — arranged around a short central shaft. When the shaft and vanes rotate, they suck in fluids or gases and impel them out the other side. Due to the hollow shape of the ID fans the speed and purpose of having id fans is not served all the time, which results in high vibration.

Question- Design the ID fan where there would be no vibrational issue

Consequence: Generation Loss.

Cause: Ingress of ash due to hollow type impeller design.

Problem 13: Mill Reject system not functional.

Introduction:

At coal handling plants we have mill reject systems, to reject the uncrushed coal and unwanted materials combined with coal. If the mill reject system is having malfunctioning the unwanted and uncrushed coal also sent along the conveyor belt. This may lead fire hazards.

Question- Make changes in the design of mill reject system which prevents fire hazards by proper commissioning.

Consequence: Fire hazard and unsafe operating condition

Cause: Inadequate Design and improper commissioning.

Problem 14: Heavy drift losses in cooling tower.

Introduction:

In cooling towers, Drift is entrained water in the tower discharge vapors. Due to the passage of hot steam through this drift, the drift is also heated resulting drift loss, which varies between 0.1 and 0.2 % of Circulation flow. Drift eliminators are used in order to reduce the drift loss, but some drift loss is still left.

Question- Suggest an economical solution so that there would be no drift losses assuming that the drift eliminator is damaged.

Consequence: Loss of Raw water and cooling tower effectiveness.

Cause: Inadequate and damaged drift eliminator.

Problem 15: Building energy conservation system

Introduction:

Every day we rely on energy to provide us with electricity, hot water, and fuel for our cars, etc... Now-a-days, the consumption of energy has drastically increased by the consumers. So to reduce the energy consumption there are many new technologies available. One such example is that in green buildings.

Question- Suggest suitable method for building energy conservation based on new technology which is more feasible.

Problem 16: Optimization of UPS utilization

Introduction:

An UPS(uninterrupted power supply) is apparatus that provides emergency power to communication loads and protective devices like relays, DCS when input power source or main power fails. Now, Optimization is defined as the action of making the best or most effective use of a resource. So, the optimized utilization of UPS with the available constraints can yield better outcomes.

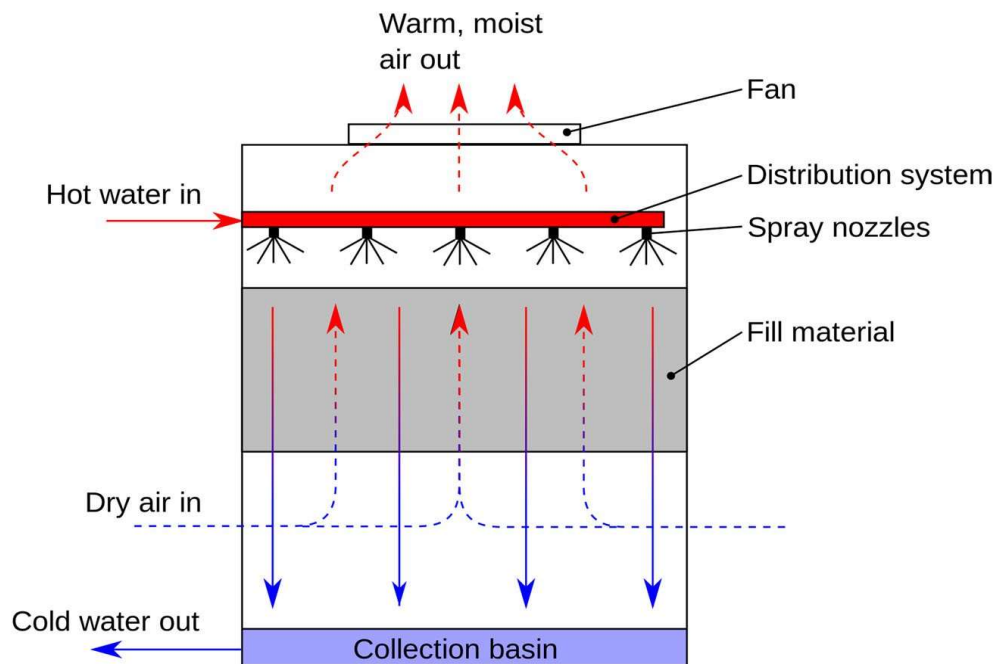
Question- Create an advanced optimized approach to utilize the generated Un-interrupted Power Supply (UPS).

Problem 17 : Enhancing Cooling Tower efficiency by 5%

Introduction:

Cooling towers are the towers that are used to transfer waste heat to the atmosphere. They use the evaporation of water to remove heat and cool the working fluid to near the wet bulb air temperature. In order to cool steam in condenser cooled water is run in pipes. This cold water absorbs heat and cools down the working fluid. In the cooling tower the heated water is cooled by exchanging heat from air. Some quantity of water evaporates and produces a cooling effect.

HOW COOLING TOWERS WORK



Question- Propose a solution for enhancing the efficiency of cooling tower by 5% by using the design parameters :

- Improving air flow by increasing the contact between water and air.
- L/G ratio

Problem 18: NVIDIA Jetson AGX Xavier Module and Jetson Nano application.

Introduction:

NVIDIA AGX Xavier developer kit, you can easily create and deploy end to end AI robotics applications for manufacturing , delivery, retail, agriculture, and more.



NVIDIA jetson nano devoleper kit is a small, powerful computer that lets you run multiple neural networks in parallel for applications like image classification, object detection, segmentation, and speech processing. All in an easy-to-use platform that runs in as little as 5 watts.

Question- Make an design for standalone software platform for creating NVIDIA Jetson AGX Xavier Module and Jetson Nano based application-specific customized PCB board design.

Problem 19: MATLAB-Simulink based programmatic approach for Multiple Maxon Motor with EPOS Controller

Introduction:



Maxon DC motor and maxon EC motor are types of a motors that works as an energy converter. The electrical motor converts electrical power into mechanical power. EPOS is a modular, digital positioning controller by maxon motor. It is suitable for controlling permanent magnet-activated motors with encoders in a range of 1 to 1050 W continuous output power. The wide range of operating modes, as well as various command interfaces, makes it versatile for use in many different drive systems in the fields of automation technology and mechatronics.

Question- Make an design for MATLAB-Simulink based programmatic approach for Multiple Maxon Motor with EPOS Controller in which you will feed a text file containing all motor's different rpm velocity & time duration in each row and the Maxon Motors will follow them sequentially start and stop.

Problem 20 : Highly accurate 3D scanning system

Introduction:

3D scanning is the process of analyzing a real-world object or environment to collect data on its shape and possibly its appearance (e.g. colour). The collected data can then be used to construct digital 3D models.

Infrared 3D scanners have been used in video games for quite some time. Whereas in video games the scanners are, for example, only able to identify if a player throws his arms up in the air while playing virtual volleyball, the new 3D scanner of the Fraunhofer Institute for Applied Optics and Precision Engineering IOF is able to be much more precise. With a resolution of one million pixels and real-time data processing, numerous applications are possible with this new device.

Question- Create a laser or infrared or time-of-flight based highly accurate 3d scanning system for small rough surface objects. First, check if it is a planner image or an abrupt surface and if it is planner then just take a normal image and if it's not planner then 3d scan the object using any of the techniques as mentioned.

Problem 21: Real-life image processing application

Introduction:

In industrial image processing, real time processing is usually the opposite of offline processing. In offline processing applications, you record images (many of them) and process them at a later time. Real-time means your implementation is fast enough to execute concurrently.

Question- Create an Electronic Circuit Diagram (+ PCB) where there is one camera sensor, one red flashlight, one green flashlight, one blue flashlight and one white flashlight & program it like when a push button switch is pressed, sequentially one of the flashlights will glow up and one pic is clicked and saved in the inbuilt memory card module within the created embedded platform. so corresponding to each click four images will be saved.

There will be another switch which if pressed live streaming of all the four-channel video will start. pressing the switch again will stop live streaming. It will have a USB interface to directly be able to communicate with any desktop for doing realtime image processing.

Note: Other problems will be uploaded soon.. Please visit again to check on 31/10/2019.....