Problem Statement for Healthcare - Innovation

1. Hip arthroplasty or hip replacement is a 90-minute procedure that starts with a 9-inch incision on the side of the hip. Then a medical instrument called an acetabular reamer is used to drill a cup share hole into the pelvis. Into this hole goes the artificial cup. If the shape of the hole for the cup doesn't precisely match the cup, there will be movement and can result in severe pain during movements. This misfit is caused by necrosis. Necrosis or the dying of cells occurs when the cells heat up beyond 55 degrees. This is the biggest challenge while performing hip replacement surgery.

2. Temperature, in this case, is a function of the rotational speed of the drill bit, the pressure that's being applied and how long it's being applied. Considering that we have the digital twin (Model + data) for the IOT acetabular reamer, we need to predict and instrument the reamer appropriately so that, Necrosis does not occur. Temperature = f (speed, pressure, time and patient demographics (optional)).

3. Application requirement - Control necrosis, control speed. Since we or the medical instrument can't control the pressure the surgeon applied or how long the surgeon applied the instrument to the bone, we need to focus on rotational speed which we can control. The application has to recognize the model or the equation and solve for rotational speed. Based on the data for pressure, time and rotational speed, we need to predict that the temperature does not go beyond 55 degrees.

4. While the sensor data is simulated and available for the model, develop a mind app which displays a dashboard, a digital Andon monitoring key KPI's and generate appropriate notifications/alerts which can prevent Necrosis. The dashboard shall also display a statistical report on all the previous events that have occurred for the particular device.

Problem statement for Industrial - Operational Efficiency, Asset Utilization

- Bucket-wheel excavators have been used in mining for the past century, with some of the first being manufactured in the 1920s. They are used in conjunction with many other pieces of mining machinery (conveyor belts, spreaders, crushing stations, heap-leach systems, etc.) to move and mine massive amounts of overburden (waste). While the overall concepts that go into a BWE have not changed much, their size has grown drastically since the end of World War II.

- A bucket wheel excavator (BWE) consists of a superstructure to which several more components are fixed. While this product costs in the range of millions of dollars, its only available 41-60% of the time. There is a challenge to increase the uptime and eliminate unscheduled downtimes.

- The excavator breaks into two places.
  a) JOINTS: The joints burn out from overheat or they grind to halt usually because there's some particular matter that gets introduced into the joint. The temperature on joints burn out because of load, angular velocity, and vibrational frequency.
  b) STRUCTURAL FRAMES: Too much weight shall crack the frame therefore to solve this problem we need to measure stress and strain. Too high stress and strain will indicate a potential crack or buckling in the structure.

- BWE is installed with load sensors, angular velocity sensors, temperature sensors and a variety of stress-strain gauges to measure the forces on different part of chassis.

- While the sensor data is simulated and available for the model, develop a UI application and digital Andon to identify if the operating parameters of the BWE are within norms and displays theses for a human operator. Generate real-time events for pro-active maintenance. Generate events to limit the lift if the stress/ strain is beyond a given threshold. Generate a trend which can enable predictive maintenance. The template for abstract submission which is to be strictly followed : Click Here

  For support please click here

General Rules :-

- Every team has to register online on the official Kshitij website for the competition.
- A Team ID will be allocated to the team on registration which shall be used for future references.
- The idea presented by the teams should be original (not protected by means of patent/copyright/technical publication by anyone else).
- A team can register at any point of time before and can submit final abstract(as mentioned in the structure).
- The decision of the organizers or judges shall be treated as final and binding on all.
- No responsibility will be held by Kshitij, IIT Kharagpur for any late, lost or misdirected entries.
- Note that at any point in time the latest information will be that which is on the website. However, registered participants will be informed through mail about any changes.

Team :-

- Participating team size should be limited to a maximum of 3 individuals.

- The students must carry valid student ID cards of their college which they will be required to produce at the time of registration.

- Students from different institutes can be a part of the same team.

Eligibility :-

Undergraduate and Postgraduate students of any discipline from emerging Universities/Colleges are eligible to participate in the competition.

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