AAVARTAN'19

VIGYAAN PROBLEM STATEMENTS

(Department of Mechanical Engineering)

INSTRUCTIONS:

1. If needed then preparing cost report will be appreciated.
2. If possible then for the final round, the CAD model of proposed idea will be appreciated.
3. Calculations analysis to support your model will be appreciated.
4. If possible then preparing a list of equipment (or whatever is the tentative type of equipment that you took into account) to be mounted on your bot will be appreciated.
5. Other projects that may be based on the themes mentioned in the end of the statement will also be accepted.
6. M.Tech students can attempt the same problems or if they have any other innovative project ideas then they can bring them as well.
7. Participant's mustn't needed to follow the given solution outline as long as their solution successfully tackles the problem and they can justify their choices. As our aim is to promote innovative ideas that when worked can prove to be effective.

1. Design an Inspection and Shoot bot for Border Patrolling

For a country maintaining border security is a very crucial task in order to maintain national security but border's passing through region's having extreme geographical conditions such as swamps/desert/dense forests etc. design a bot for border patrolling that can be mounted with different image sensing and thermal imaging equipment for inspection and monitoring purposes and an automatic gun.

Problem objective:

1. Create a design of a bot that can navigate rough and uneven terrains.
2. The bot design must take into account the different sensors and other equipments to be mounted on it.
3. Since the bot is to be designed for border inspection it should have a mounted firearm or a stun gun, and bot should be able to handle the recoil of the mounted weapon.

2. Design and Construction of Rescue Robot and Pipeline Inspection

Underground drainage and sewage systems are currently the best way to move sewage out of the city in a hygienic way, other than this underground pipelines are also a very good way for water, electrical lines distribution but timely inspection of these pipelines are very much required for their smooth and proper working but it's quite a laborious task and requires a lot of manpower and a lot of time consumption. Design a compact bot capable of performing pipeline inspection and can transmit A/V signal if needed incase if a worker is stuck in the pipeline while performing maintenance.

Problem objective:

1. Design a bot capable of performing pipeline inspection.
2. The design of the bot must take into account all the necessary sensing equipment that may be required for the task.
3. Bot may be included with an arm for performing small tasks such as clearing small objects or be able to help in case of an emergency/rescue task

3. Passive Car Cabin Cooler

Suggest a car cabin cooling system which instead of working on conventional cooling method such as AC uses other methods that can improve vehicle efficiency reduce waste gas emission that are done by AC cooling system of cars. Rather prepare a model exploring other methods to cool car cabin that won't actively draw power from car but rather based on utilizing the relative motion of vehicle (the movement of air around vehicle while it's moving) and other such methods.

4. Study the Design of Human Skeleton and Design an Exoskeleton Suit Supporting Knees and Thighs and Ankles for Old and Specially-abled People

Problem objective:

1. Design affordable exoskeleton prosthetic for old age/specially abled people to support their body.
2. The design should specify the targeted regions of the body to be supported; also it should not be too bulky so as to restrict movements in other directions.

5. Fire Truck Concept Vehicle

The Fire services are not well organized in India. In recent years, the requirements for fire safety cover have increased manifold whereas the development of Fire Service has not made much headway. The setting up of Industrial Plants at a fast pace with extensive use of hazardous materials and the construction of larger and taller buildings have multiplied the problems of fire fighting. The fire hazards are no longer confined to big cities and manufacturing centers only. Vast quantities of hazardous commodities are daily moved by different modes of transport all across the country posing complicated fire rescue problems. If the objective of ensuring safety of life and property in urban and rural areas is to be achieved, then a complete overhauling of fire service organization is called for. The fire services need to be organized properly with adequate infrastructure and equipment for keeping pace with the advancement of technology and economic growth. And due to this rapid development, the availability of space on roads have also decreased rapidly

Propose a concept vehicle for fire safety

As we know a fire truck and a fire engine are generally used in many countries where a fire engine carries water and help putting off the fire and a fire truck transports firefighters and their equipment to the scene, suggest a similar model optimized for Indian roads where the main vehicle can be made more compact and multiple support vehicle's along with it can be used for performing different tasks required to support in the situations.

6. Design and Manufacturing of Easy Accessibility Ramp in Public Transport for Handicapped People

Problem identification: INACCESSIBLE INDIA- As we all know that a large population of India is mainly dependent on public transport for travel purposes , yet it's sad to say that a group of people doesn't get access to these facilities because this group of people was ignored during designing of these transport vehicles. We are talking about specially-abled and old age people who cannot climb the steep stairs of trains though government of India have tried some measures but none of them seems to be efficient enough to be adopted nationwide, some of them are time consuming and some are just too complicated for people to use. Suggest a detachable ramp design that can be quickly attached and act as an access path for wheelchairs for train coaches and then as quickly be detached.

Problem objective:

1. Ramp needs to be strong and stable enough to support a person on wheelchair and a companion minimum 200kgs weight resistant.
2. Minimalistic time delay to be caused by operation of ramp.
3. Easily usable so that a station worker can operate it.

7. Intelligent Robot Motion Control & Data Acquisition System for Industrial Monitoring Using Image Processing Techniques

Problem objective:

1. Design a bot for the purpose of industrial monitoring, for the purpose of this participants can choose any particular sector of industry or industrial plant and target their design for that specific purpose.
2. The bot design must take into account all the required equipments that will be mounted on it.

8. Redesign a Truck's Cabin to Reduce the Number of Blind-Spot to the Driver

Often the reason behind accidents involving a truck and other vehicles such as bikes/cars is because the truck driver wasn't able to see the other vehicle. The normal driver's cabins on a truck often have many blind spots when it comes to visibility of smaller vehicle just in front of or next to the truck.

Problem objective:

1. Suggest design changes or any other modifications to reduce the number of blind spots for truck driver.
2. The suggested change should be economically viable.

9. Waste Heat Management/Recovery

Waste heat is heat, which is generated in a process by way of fuel combustion or chemical reaction, and then "dumped" into the environment even though it could still be reused for some useful and economic purpose. The essential quality of heat is not the amount but rather its "value". The strategy of how to recover this heat depends in part on the temperature of the waste heat gases and the economics involved. Large quantity of hot flue gases is generated from Boilers, Kilns, Ovens and Furnaces. If some of this waste heat could be recovered, a considerable amount of primary fuel could be saved. The energy lost in waste gases cannot be fully recovered. However, much of the heat could be recovered and loss minimized. Prepare a model regarding the same and showing how to optimize this system.

OTHER PROJECTS ON GIVEN THEMES WILL BE ACCEPTED

1. Alternative energy project involving fuel cells.
2. Water management and conservation.
3. Models for smart solid/liquid waste management.
4. Smart materials for various applications in machine design.
5. Process and enthalpy drop survey of turbine in a power plant and suggestions for increasing the efficiency.
6. Micro hydropower plant for Indian irrigation canals.
7. Cost-effective solutions to improve the quality of Indian rail travel/operation of railways.