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Modular Interior Design for an Ambulance

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***Abstract*: This project addressed the need to designing more safe and efficient interior of the future ambulance in India. Methods used are: The study sample contained paramedics in various districts. Data was collected by using a revised and complemented questionnaire based on literature review. In relation to the efficacy and safety of work, answers related to storage closet showed to be the highest, and the most difficult part of paramedic work in an ambulance was lurching. CPR is the most frequently used emergency care inside an ambulance, but 66% of the paramedics responded that accurate CPR is not possible during vehicle transfer. Safety belts are not worn for 82.8% of the time, because of discomfort (51.3%). 13.8% of the paramedics responded that stretchers are unstable, 29.5% had an experience of having patients fall off the stretcher inside an ambulance. There were comments on installing equipment's to prevent noise, and assist communication.**

***Keywords*: Ambulance Interior Design, 3D Modelling, Pro-Engineer**

1. Introduction

A modern version of a conventional ambulance with crucial medical equipment that can be vital to save the patient during a critical condition. The conventional ambulance is just a vehicle which can take a patient or victim from a point to a hospital leaving the patient unattended with some basic first-aid, these few minutes can be a question of fatality for the victim. A modern ambulance which can offer the patient in-transit treatment which can be extremely vital to save the life if a patient. Few add-ons to the life saver in addition to all equipment found in a conventional ambulance are like a pulse oximeter, transport ventilator, nebulizer, along with creature comforts considering NHV factor are noise insulated cabin, stretcher with suspension consider the rigid axle hard ride of most ambulances. A stretcher which takes up most of the space in the interior must accompany the patient till the hospital which can reduce the time required to transfer the patient. The first treatment is carried out with the help of surgical equipment stored in specific allocations to carry out swift and efficient treatment. Using power efficient led lighting systems which run on auxiliary power supply from a battery pack. In a country with 50% cases of loss of life during transit we need anything but a need of an efficient and modern ambulance with state of the art interior.

2. Literature survey

A. International status of ambulance service

About 50,000 ambulances travel on U.S. roads every day. In 2010, there were more than 250 U.S. ambulance crashes that were reported in the news media. Many more ambulances must have been involved in major accidents that did not make it into the headlines. During such accidents, emergency medical technicians (EMTs), who ride in the ambulance patient compartments while caring for patients, are at high risk of suffering injuries. Restraint systems are the first line of defence against injuries or death; however, using restraints makes it difficult to access items and treat the patients. Nevertheless, improving safety necessitates EMTs to remain restrained and to locate most of the items required to perform a wide range of clinical services within arm's reach. An ideal layout of the patient compartment and location of the equipment, medicine, and supplies should optimize performance of the EMTs while ensuring their safety.

B. National status of ambulance service

The real concept of an ambulance is missing in India. Existing ambulances are more like transport vehicles and any vehicle suitable to lay a patient is called an ambulance without consideration to the overall ambulance design. Research has shown that ambulances are more likely to be involved in motor vehicle collisions resulting in injury or death than either fire trucks or police cars. Unrestrained occupants, particularly those riding in the patient-care compartment, are particularly vulnerable. It is, therefore, all the more necessary in an ambulance to take care of occupant safety, patient care ergonomics, medical equipment selection & placement, vehicle engineering & integration, etc.

C. Types of land based emergency vehicles based in India

1) Basic Life Support (BLS)

Fig. 1. Basic Life Support Ambulance (Source: www.google.com)

It consists of a stretcher, oxygen cylinder and driver. Specially used as a blood donation vehicle.

2) Neonatal vehicle

Fig. 2. Neonatal Vehicle (Source: www.google.com)

Similar to ALS ambulance but equipped to transfer critically ill new born child (Neonate-Newly born/less than 30 days of age). Special equipment like Transport incubator, Neonatal ventilator, etc. included.

3) Advance life support vehicle

Fig. 3. Advance life support vehicle (Source: www.google.com)

Also referred as cardiac ambulance. It is used to transfer clinically critical patients requiring ventilator support, constant monitoring of ECG/BP/respiratory rate. These ambulances are equipped with Ventilator, Multipara monitors, Defibrillator, Syringe pump and Pacemakers. Doctor and nurses provided on-board.

3. Methodology of plan work

The total duration of the project work is 7 months. Each month will consist of a specific task. The first month will be a literature survey and last month will consist of real world testing of the implementations. The total work of the project will start from scratch from drafting designing fabrication and fixing. The month of July will be for literature review wherein we gather all the necessary information and details of the specific regulations for the interior of an ambulance. The designing and drafting will be the next step and later will be followed up by fabrication work on selected materials.

Table 2
Gantt Chart

WORK	July 19	Aug 19	Sept 19	Oct 19	Nov 19	Dec 19	Jan 19
Literature Survey							
Design of interior							
Material Selection							
Fabrication of interior							
Installation of setup							
Testing and analysis of setup							

4. Design

The interior is to be designed considering the factors like factor of safety-maximum comfort to the patient and accessibility to the doctors and supporting staff for the treatment of the patient.

Design is divided into two major parts first the interior design and second is the design of stretcher. It gives an overview of the space accommodation for various accessories to be equipped in vehicle. The design i.e. CAD modelling is performed by using software's such as PRO-E and Solid works. Design gives the optimum size and shape of the vehicle.

5. Conclusions

The suggested practical layout contains five main modifications.

1. Developing specially designed belt is needed for paramedic safety & efficient work.
2. The seats are Foldable and moulded to be ergonomically friendly.

Table 1
Summary of Research

Title & Author	Research Methodology used	Remarks and conclusion
The Affordable Care Act and Ambulance Response Times, Charles Courtemanche, Andrew Friedson, Andrew P. Koller, Daniel I. Rees	3D Modelling, Finite element analysis, CATIA-V5, ANSYS	This paper focuses on increasing the response time by implementing less paperwork and improving wireless technology
Patient Perceptions On the Use of Driverless Ambulance: An Affective Perspective, Scott R. Winter, Joseph R. Keebler, Stephen Rice, Rian Mehta, Bradley S. Baugh	ANSYS, CATIA V5	In conclusion, this study determines the perspective of a patient's willingness to ride on a traditional configuration as opposed to a driverless ambulance
Improving Fairness in Ambulance Planning by Time Sharing, C. J. Jagtenberg, A. J. Mason	3D Modelling, SOLIDWORKS, ANSYS	In this paper we find that the efficiency of ambulances can be improved by time sharing perspective by ambulance..
A Research Study of Ambulance Operations and Best Practice Considerations for Emergency Medical Services Personnel, Larry W. Avery, Thomas B. Malore, Carlotta M. Bonne	CATIA , SOLIDWORKS, ANSYS	The result is a lighter, faster, and more agile vehicle that improves go-kart design.

3. Equipment's to secure the body and safety devices for CPR are needed.
4. System improvement for communication between the driver seat and paramedics is needed.
5. The stretchers are moulded to be maximize efficiency and minimize injury.
6. Designing interior cabin in such a way that space limitations can be overcome.

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