

# ALL PURPOSE AMBULANCES MADE USING RECYCLED MATERIALS AND USING INNOVATIVE CONCEPTS OF COMMUNICATION

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**Abstract:** Good quality healthcare service is one of the most vital requirements in India. However, there has been a lack of focus on preventive health care. Low quality, lack of basic and critical equipments and technology, outdated methods to control infectious diseases, delay in prompt healthcare services, high cost and risk, rural and urban healthcare divide; the problems with healthcare in India is endless. Although, the number of good healthcare providers has steadily gone up, it is not helping to address the larger Indian health crisis.

To mitigate the poor healthcare services problem, technological advancements are required. Integrated systems of providing health, from the patients to the doctors, are essential. Keeping all of that in mind, we need to revamp our mobile healthcare service and ambulance model. This study mainly focuses on the reasons why this should be the top priority today. It also presents the theoretical framework and design of a modern all-terrain ambulance, built with recyclable materials and using the concepts of human-to-machine interaction. Using signals as detection techniques and the proper response technology and plan, a patient's condition can be detected, analyzed and immediately picked up for treatment, if needed. A fully equipped ambulance will then treat the patient and make proper decisions to save the person. The goal is to eliminate the problems of healthcare services.

**Keywords:** All purpose ambulances; Ambulance, APA, Communication, Innovative, Recycled materials;

## I. INTRODUCTION

Healthcare services in India still have a long way to go before being fully equipped, self sufficient and operational. Unlike the health services in the developed countries, the lesser developed countries like India face some major roadblocks to healthcare. Some of them are mentioned herein:

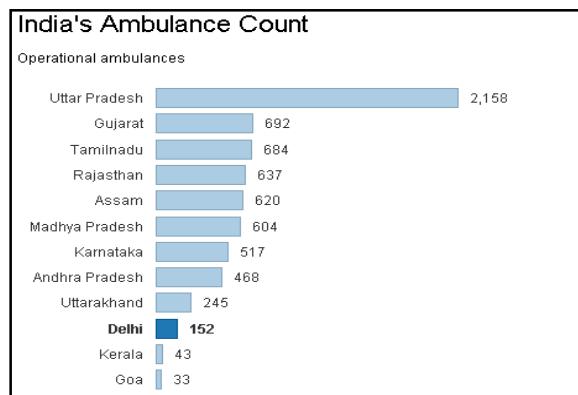
1. India spends around 4% of its GDP on healthcare (18% in USA) [1]. This is not adequate to improve the overall healthcare.
2. There is a difference in healthcare facilities in the rural and urban areas, which affects the attempt to unify healthcare services as one. Nearly 70% of the population still lives in rural areas and has limited or no access to hospitals and clinics [2]. They come to major cities for healthcare but cannot provide the cost or get proper treatment.
3. An extremely low percentage of people are covered under Health Insurances.
4. For primary healthcare, the Indian government spends only about 30% of the country's total healthcare budget [3].
5. Underdeveloped Medical Devices Sector
6. India has one of the worst Ambulance services in the world. Its outdated design and lack of a proper integrated and technologically advanced system, makes it nothing more than a goods carrier vehicle.

Although these are major setbacks, there is also ample scope of improvement. Rethinking the whole

mobile healthcare and the emergency response system will benefit all.

## II. THEORY

The Indian emergency medical response system needs immediate design and infrastructure reform. The number of ambulances is extremely low and they are divided majorly in urban areas. This results in a lack of availability of healthcare in rural areas.



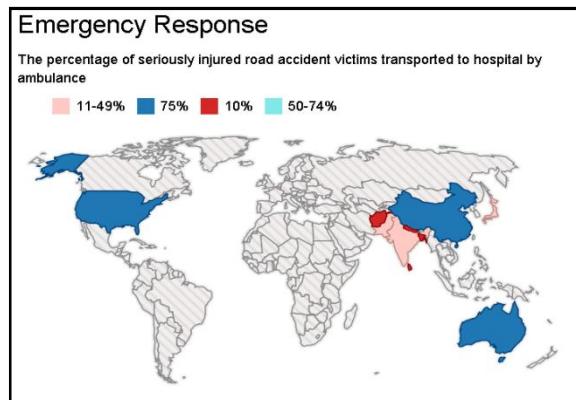
**Picture 1:** India's ambulance count is extremely low and ill distributed [4]

As an example, Delhi, a city of 22 million people, has 152 state-run ambulances. That's one for every 144,736 people. The World Health Organization says there should be at least one ambulance per 100,000 people [4]. The rural and urban areas have different healthcare facilities. In the urban areas, there is an

abundance of hospitals, clinics and nursing homes (government run or private) but they cannot get the patients treated. This is either due to delay caused by transporting the patients or that it is non-affordable or it even might lack some infrastructure. In the rural areas, there is a lack of doctors and poor infrastructure, equipment and treatment efficiency. In both urban and rural areas, ambulances can serve crucial roles.

1. New all purpose ambulances stationed in major areas of accidents can offer prompt service, both in rural and urban areas.
2. Ambulances require less personnel, cost to maintain and run. They can be a cheaper alternative to hospitals, in times of need.
3. In case of overcrowded hospitals, these ambulances can treat minor cases and decrease the working load of hospitals.
4. During emergencies, the ambulance will get a "right to path" and each will one will have designated areas of coverage.
5. In rural areas, mountainous regions or other remote places where hospitals are not present, the all purpose ambulances are a perfect way to treat patients.
6. With updated equipment and technology its functional capability is 40 years (min.)

In USA or Europe, ambulances are self sufficient operating units and can heal or at least treat all kinds of patients. Such is not the case in India, which is concerned only with transporting the patient. As an example, majority of deaths each year in India are caused by road accidents and a delay of the emergency response unit.



**Picture 2: Low percentages of seriously injured road accident victims are transported in hospitals by ambulances in India, WHO [4]**

## II. DESIGN

The external and internal design of these ambulances will be different from the conventional Indian ambulances. It will reflect the designs followed in the US or Europe, meet all the minimum requirements of the EMS ambulances [5] and incorporate advanced ideas of healthcare and communication. The *Basic*

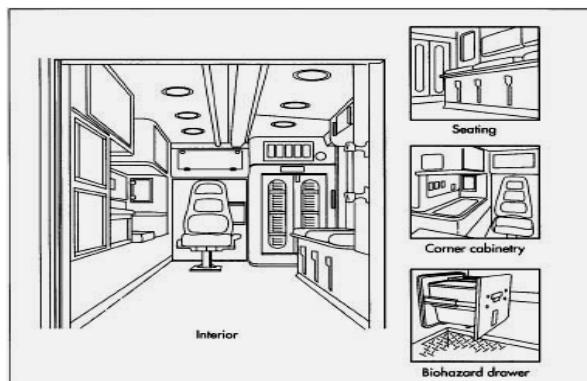
*Life Support (BLS)* ambulances of today must be replaced with *Advanced Life Support (ALS)* ambulances. The All Purpose Ambulance includes all the features of ALS along with advanced design and communication.

### 3.1 Exterior and interior design of the All Purpose Ambulance (APA)

Design of ambulances is divided into three types [6]. The APA will fall under the *Type III* which has a modular body built on a cut-away van chassis. This design combines the capacity of the larger modular body with the walk-through accessibility of a van. The occupants of the cab can easily enter the body from the inside, although the interior space is not compromised.

The body framework is usually made of formed or extruded aluminum. The outer walls are painted aluminum sheet, and the interior walls are usually aluminum sheet covered with a vinyl coating or a laminated plastic. The subfloor may be made of plywood or may use an open-cored plastic honeycomb laminated to aluminum sheet. The interior floor covering is a seamless, industrial-grade vinyl that extends partially up each side for easy cleaning [6]. However, unlike the traditional models, the APA will incorporate the use of Aluminium made from used cans, sheets and other scrap items. These scraps can be treated and mixed (in a certain proportion) with industrial aluminium and then formed. The recycling of scrap aluminium is important to reduce our waste matter. Further the framework will be manufactured by 3D printing, making it fast, easy and cost less.

Recycled plastic will constitute most of the interior walls, floor, cabinets and doors in the patient compartments. Exposed areas must be covered with shatter-resistant plastic paneling. Stainless steel sheets are also required to resist the effects of blood and other body fluids from a patient. Upholstered areas must have flame-retardant foam padding with a vinyl covering. Handles or other interior trim pieces will be made of various recycled plastic materials.



**Picture 3: Standard interior of an ALS ambulance [6]**

The APA will also have an improved suspension system which can absorb the shocks of Indian roads. The ground clearance of the vehicle will be increased to prevent it from getting stuck in floods and potholes. Ramps will be attached below the rear doors to lift patients into the ambulance (Picture 4). The patient beds must be high and have revolving wheels for transportation. A separate water cylinder will be added to provide water for treatment. Basic water purifiers will be present, to provide clean water for drinking as well.



**Picture 4:** Ramps help lift critical patients and also the disabled patients into the ambulance

### 3.2 Advanced Equipments

All ambulances have to carry advanced equipments like cardiac defibrillators, along with an arsenal of life-saving medicines and drugs. The common equipments like heating and air conditioning The APA will contain a GPS tracking device and a radio frequency receiver. These devices will track the patient, with both the GPS and the radio signal and tell if the patient needs medical attention. The APA must also have a medium to access the wearable device for any basic details and medical records of the patient. It is assumed that such a device will contain such information beforehand and can be easily accessed by the doctor or attendant in the APA.

The importance of a wearable device tracker and reader lies in times of emergency. During this time, the patient becomes incapable of sending any form of communication. Detection of such patients is the first hurdle. A lot of patients can be saved by this method. Prompt treatment can only occur if the patient is identified, using any abnormal health signs. The APA must have a portable computer which can properly read a wearable device (through an USB port) to access the basic information and medical symptoms of the patient. A case file can be prepared based on the information and treatment rendered and submitted to a hospital, if the patient needs to be transferred to it.

The inclusion of messaging through mobile phones can also be an added feature in the communication

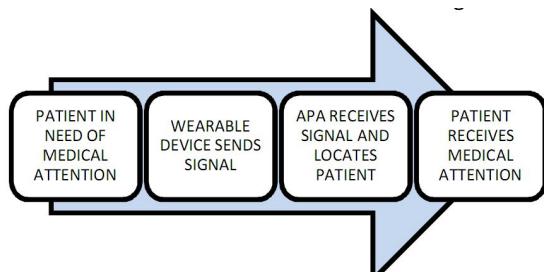
components, the oxygen system components and refrigerators must be in-built. A properly designed and refrigerated blood bank will also be present, which will contain at least one pouch of each type of blood.

The APA will have all the medical equipment to treat the top ten causes of death in India. According to the WHO statistical report on India, Ischemic heart disease was the leading cause of death, killing 1215.4 thousand people in 2012 [7]. Some of the diseases like stroke, diarrhea, birth complications, TB, self-harm and road accidents [7] can be treated in the APA before sending the patients to hospitals. This can be extremely beneficial to people living in rural areas.

### 3.3 Advanced Communication Methods to Track and Treat a Patient in Need of Medical Attention

Communication improvement is a must for the EMS. Most ambulances have radios installed. Contact via radio does not encompass the patient. The source of information must be from the patient. The concept of advanced communication will be achieved through a wearable device, situated on the patient's arm or wrist. This device will send a signal once a particular condition of the patient grows abnormal. The APA will then move to the patient's location and treat the patient, if required.

process. The attendant present at any ambulance will only require a mobile phone to receive a message from the patient. In case of any abnormalities in the pulse rate of the patient, for example, the wearable device present on the patient will transmit a message which will be received by the mobile phone of the nearest APA attendant. If the medium is via the GSM technology, the mobile number is not required. Also, the person in distress may or may not have a mobile phone but will be able to send a distress signal. The mobile phone present in any APA will alert the attendants and also receive an SMS. In the future, this message can be packed with information about the immediate health condition of the patient.



**Picture 5:** Process flow of the working of APA

The APA must have a certain working radius to be able to receive the patient's distress signal. Within

its working radius, the APA will receive and attend to any patient/s based on this distress signal. It will provide medical aid and contact the proper authorities, if there is a different emergency (like fire or a natural calamity). Each ambulance will have its designated working range and must be able to cover that range effectively. The number of APA's in a range will be increased based on its capabilities of working or the load of patients on it, at a particular time. Picture 5 provides a process flow of the working of a single All Purpose Ambulance (APA).

## CONCLUSION

The benefits of setting up mobile all purpose ambulance units will be immediate. Not only will it provide the proper medical attention to the patients but also the patients will not have to go to a hospital in case of an emergency.

1. Those areas will get immediate relief where medical facilities are scarce.
2. Places where it is not possible to construct hospitals can have APA units.
3. The rural areas can be accessed and patients can be treated in rural areas.
4. Over-crowding in major hospitals will be reduced.
5. With state-of-the-art medical equipments and latest communication methods, the APA will be equipped to save lives as the ambulances in more developed countries.
6. Traffic congestions will not delay medical treatment as the APAs will be equipped to handle all medical situations.

There are many other uses of the All Purpose Ambulances and it can attract medical professionals to the rural areas, in the future.

1. As per the 2015 Ambulance Code of the Government of India [8], all the vehicles transporting the patients can directly come to the APA. New communication mediums can be established within the transporter ambulances and the APAs to carry and treat patients faster.
2. The APA can initiate blood donation camps to collect and store blood. This will be extremely useful in emergency situations. Storage and transportation of blood in blood banks will not remain a problem as the blood can be directly used by the APA.
3. Similarly, vaccination camps can also be arranged which will now have more widespread results.
4. Health education camps can also be undertaken by the APAs to train the people about diseases and its preventive means.

The benefits of the All Purpose Ambulances are plenty and it tackles with nearly all of the health related problems faced by our country. Although capital is needed for this venture, the future looks promising.

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