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INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/11782
DOI URL: http://dx.doi.org/10.21474/IJAR01/11782

ISSN NO. 2320-5407

RESEARCH ARTICLE

CONCEPT PAPER: INTELLIGENT TRANSPORTATION SYSTEM FROM CRASH VICTIMS (ITS-CV)

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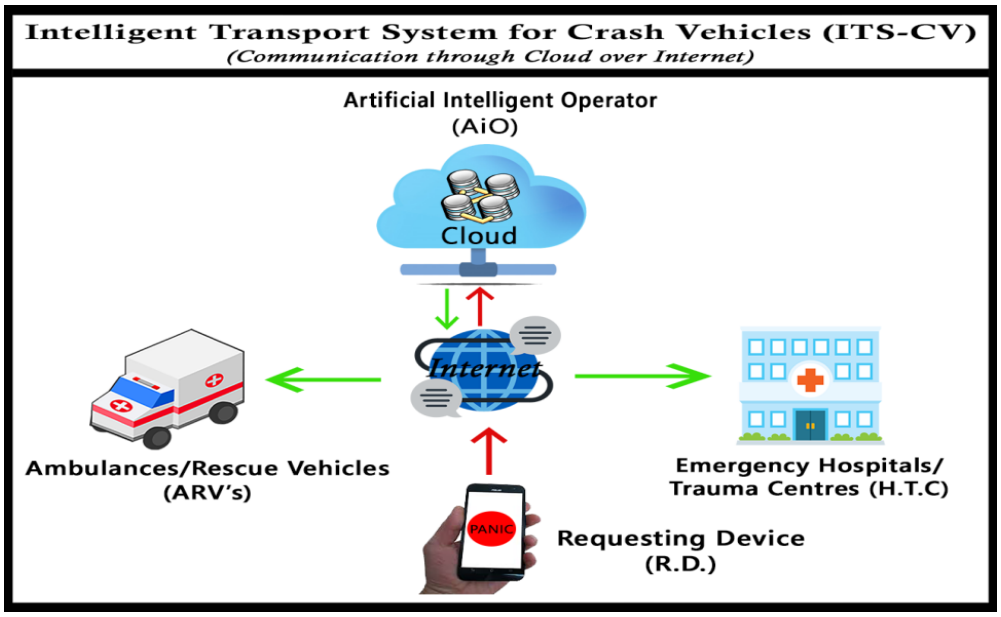
Manuscript Info

Manuscript History
Received: 25 July 2020
Final Accepted: 28 August 2020
Published: September 2020

Abstract

Quick transportation of crash victims to the hospital is a critical parameter. The existing methodology of dispatch of ambulances by verbal reporting, dialing emergency helpline or computer aided dispatches can be further refined. The ITS-CV aims at bringing all ambulances on a common platform through a Artificial Intelligence operator which connects the crash site, the ambulances and the response hospitals or trauma centres and provides them with the shortest clear route or even creates a green corridor. The system can also cater to other natural or manmade calamities, or health emergencies.

Introduction:-



The concept of the "Golden hour" or "first hour" after road accident/crash has been in existence for more than two decades. The chances of survival of the crash victim by quick transportation to the hospital are critical in this phase.

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The term “platinum ten” or the first ten minutes of arrival of the first aid vehicles and the start of assistance have further qualified the phrase.

The chances of survival of the road accident victims would depend upon the following three parameters:-

1. **Severity:** The type of injuries suffered by the victim in the road accident and the deterioration due to late arrival of rescue team.
2. **Distance:** The actual kilometers between the victim/place of accident and the place of transportation or hospital.
3. **Time:** The time taken by the responders to transfer the victim to the hospital.

Thus, the deliverance of immediate response to the victim from place of accident to the hospital is important.

The need to replace the existing methodology of transporting accident or crash victims arises from the delay that occurs due to the following:-

1. Dialing emergency number – There are usually multiple emergency numbers and there can be wrong dialing of a number due to panic.
2. Verbal Reporting – After connecting with the emergency number, the ground situation needs to be verbally explained accurately and swiftly to the responders. Wrong or delayed information can lead to possible deaths.
3. Ambulance Dispatch – Choice of ambulance i.e. type (Basic or Advanced Life Support) and location from where it has to be mobilized (nearest) needs to be done efficiently. At present, this decision is taken by non-technical operators using Computer Telephony Interface (CTI) and Computer Aided Dispatching (CAD) and is prone to errors.
4. Nearest/Suitable hospital - The transportation of the victim to the nearest and most suitable hospital/emergency care is usually based on ground or field knowledge of responders and heuristics.

Existing System for Ambulances

In the present scenario the crash victims are evacuated either by the Ambulances of the health department or by the police by their semi-equipped patrol vehicles through the emergency dial number or are evacuated by private ambulances and common citizen by private efforts. As described above, it is mostly manual and is not coordinated, hence needs to be brought to a common platform for efficient utilization of the existing resources. The task is not simple because of the various players involved, the difference in the standards of ambulances (as they are not operating as per existing guidelines) and no proper coordinating agencies or platform available.

Proposed Changes: The ITS-CV

The solution lies in bringing all these rescue vehicles on a common platform in a phased manner. The same can be achieved in two phases.

Phase-I: Bringing the government run ambulances + the ambulances of the NGO's operating with the police + the highway patrol vehicles of the police department on a common digital web based platform.

Phase-II: In the phase-II based on the success of the pilot project the rest of the private ambulances with the pre-requisite facilities and the Police Control Room (PCR) vehicles could be added to the common platform.

Rest of the discussion on the intelligent transportation system for crash victims ITS-CV will be based on the assumption of the Phase-I.

Taking a leaf out of companies like Ola & Uber, who use GPS-based mobile apps to reach customers in double quick time, an automated tactical response team needs to be developed using latest technologies like artificial intelligence and cloud computing.

Conventionally the victim or the bystander calls the emergency response number usually “108 or 112”, waits for it to connect first and later submit the details of the site of crash and the ways to the place. The response center has the fixed location of all the ambulances and an operator in the response center guides the nearest ambulance to the place of accident. The victim is then taken to the hospital by the rescue team which is decided at the spot itself. Going by the concept of the golden hour and the platinum "10" every minute is crucial and much precious time is lost in this manual exercise.

This crucial time can be critically reduced by reducing the information flow from the victim site to the service provider, from the service provider to the ambulance and the ambulance to the hospital.
The era of information technology is now a vital part of human existence and the usefulness and the dependence on Smartphone's has increased exponentially especially with its wide reach.

The combination of mobile-based applications (Android) and an autonomous cloud based **Artificial intelligent Operator (AiO)** can drastically reduce the delay in communication process and the transportation of the crash victim from the site of crash to the place of emergency care or treatment.

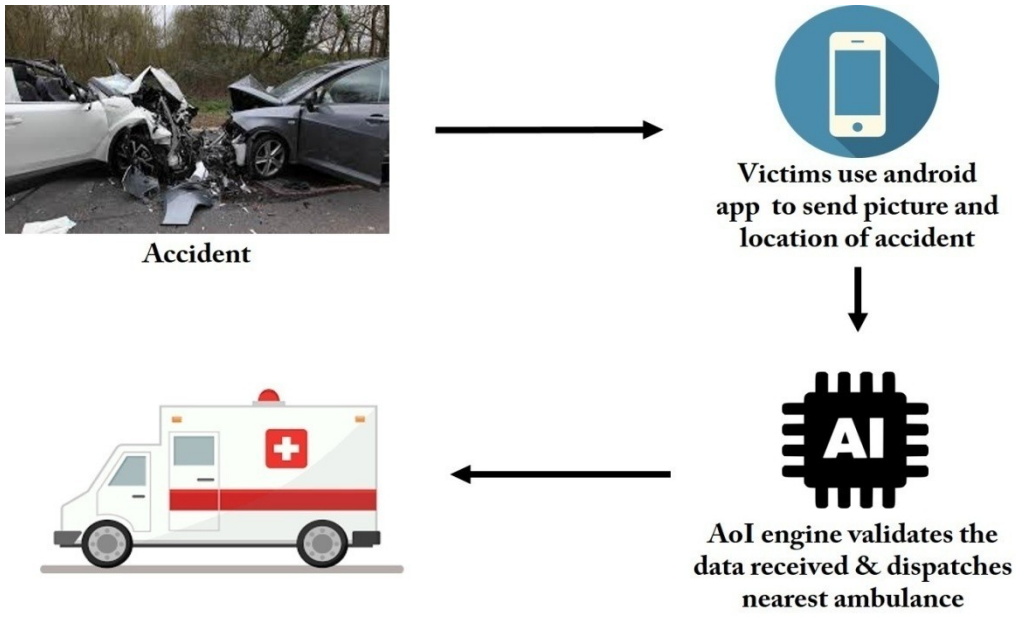


Figure 1:- Process flow of new methodology.

Concept- Assumption
The concept is based on the following assumptions which are not insurmountable limitations.

1. Requesting Device (R.D.) – A Smartphone running Android OS and having internet & GPS services.
2. A Smartphone running Android OS in the ambulance/emergency vehicle.
3. The victim is conscious enough to use the R.D. or the fellow traveler or bystander would use the phone for an alert as a R.D.

Components of proposed ITS-CV
The ITS-CV will have the following integrated sub-systems.

A: The Requesting Device (R.D.)
The requesting device would be the user end android smart phone with an app (as per the project) which would be used to send the request. It may be of the victim or the co-traveler. The app will be a lightweight application, which would just require the informer to enter the severity of the accident. Once entered, the app will send the degree and location of accident via internet and GPS.

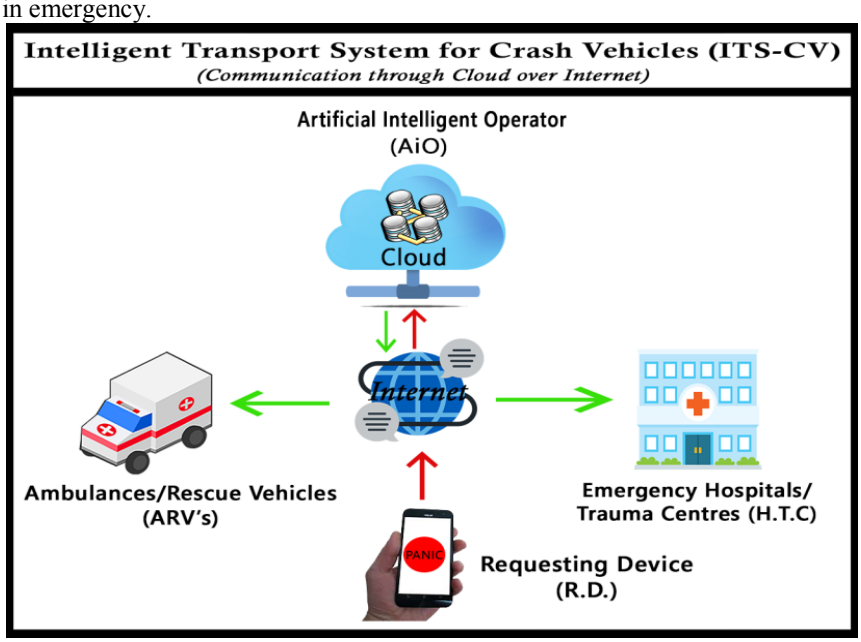
B: Autonomous cloud based Artificial intelligent Operator (AiO)
The RD will forward the information to an "AiO" which will be at the core of the entire system and will be responsible for taking in requests from victims via RD, processing them, dispatching suitable emergency vehicles and informing hospitals.

The AiO will have two sub-systems:-

1. Ambulance side sub-system
2. The hospital or the trauma centre side sub-system.

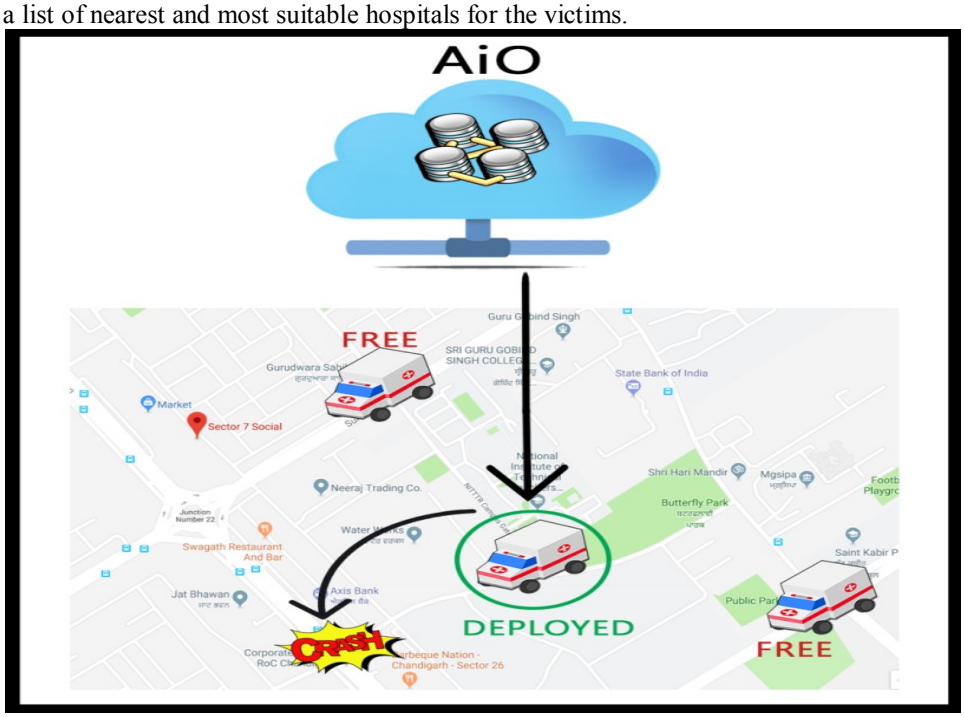
The ambulance sub-system will match the GPS co-ordinates of the existing fleet of ambulances with specially designed algorithms to get a real time location of the nearest and available ambulance to the R.D. and make it reach the spot of crash with a navigation map. The system will also distinguish between the types of ambulance required (Advanced or Basic) according to the health status of the victim.

The hospital or the trauma centre side sub-system will be responsible for informing the relevant hospital about the incoming patients in emergency.



C: Ambulances/Rescue Vehicles ARV's

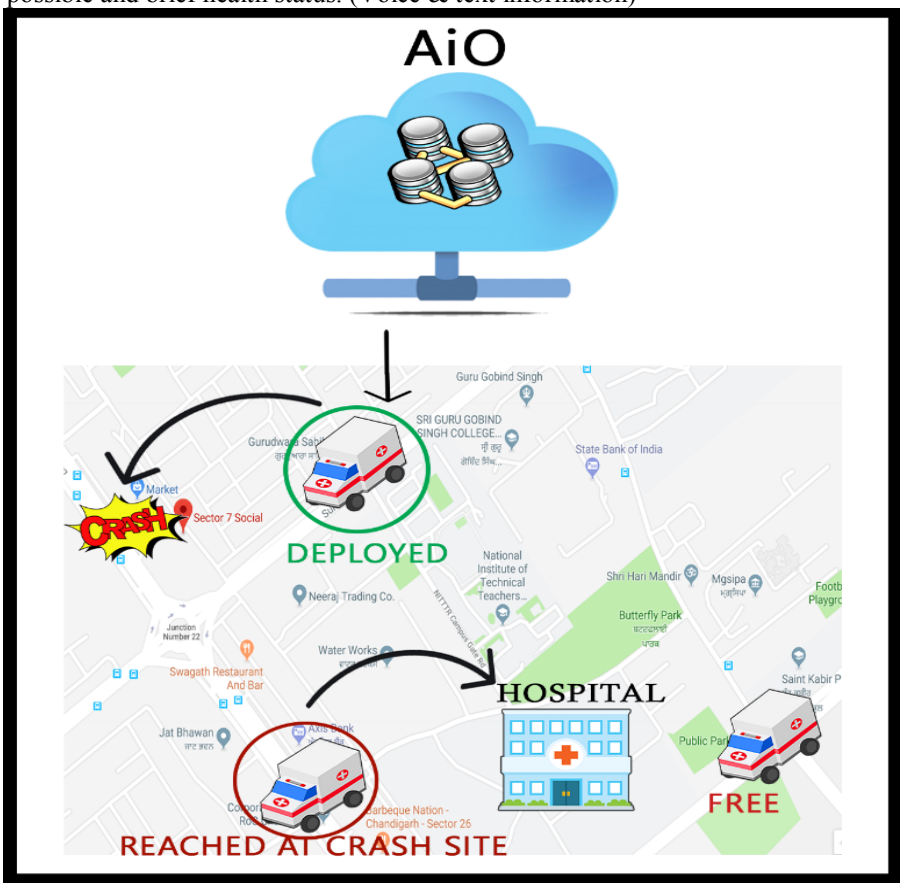
These would be either ambulances or in rare case the police patrol vehicles which would have the android devices with requisite applications and maps to rescue the victims from the spot and reach the designated hospitals through shortest routes provided by the application. Upon reaching the accident spot the android phone application in the ARV will display a list of nearest and most suitable hospitals for the victims.



D: Emergency Hospitals/Trauma Centers: HTC
The hospitals so designated and identified in advance would also have communication with the AiO and receive real time advance knowledge about the arrival of ambulance so as to prepare for the patients in advance.

Communication process of the proposed ITS-CV
A Between the RD and the AiO
The communication between the RD and the AiO can be triggered either in form of a panic button or an application which can send the location and severity of accident of the victim to the AiO.
B Between the AiO and the ARV's
This would be two way communication process. The AiO would indicate all ambulances as either (i) Available (ii) Non-available or (iii) On duty.

The system on identifying the nearest ambulance would send a request to the ARV and the ARV would respond in yes or no. In case of no (inoperable etc.) the AiO will relocate the nearest ambulance for a request. AiO would then send a road map to the site of the R.D. The hospital sub-system would also send the designated place of arrival or hospital/ Trauma centre, HTC with a road map for quick transfer.
C Communication between the ARV's and Hospitals
The ARV's would then convey to the hospital advanced information regarding the arrival of the victim the expected time of arrival if possible and brief health status. (Voice & text information)



Challenges in the implementation & solutions
The system should be able to perform even in absence of a refined hospital sub-system:
(1) The hospital sub-system can be refined later and the AiO can guide the ambulance to the victim and then transfer them to the nearest hospital.
(2) The requester device (RD) may call manually and the rest of the system takes over and the ARV's reach the spot quickly.

(3) The challenge of duplicate calls (from various RD's) to the same event needs to be filtered by the AiO by computing the exact location so that multiple ARV's are not rushed to the same spot.
(4) Pilot project with various players and systems components along with dummy runs would reduce or eliminate most of the obstacles. The results when compared with the existing system would prove the benefits of the proposed system.

Huge Advantage of the ITC-CV

The huge advantages of the ITS-CV over the existing manual or semi-automated systems are obvious:

1. Reduction in Response time
   The most important advantage are decrease in response time due to digital automation and use of navigation maps and matching the RD's, ARV's and hospitals (HTC's) which are nearest to the accident sites with the shortest route maps.
2. Reducing human error
   By reducing human interaction and automation the human error is minimized, wrong information from the victim end might lead to arrival delays. If the victim is new to area, or does not have the number for requesting response, he can still request assistance by the ITS-CV and even fraud calls are eliminated (or easily identified). The operator may also send wrong information to the ambulance and all such errors reduced by GPS, GIS and automation in the ITS-CV.
3. Efficient allocation of existing resources
   By automation, the existing resources are optimally utilized without duplication and better victim care is assured.
4. Lesser cost and human efforts are involved.
5. In the advanced version a better patient care and chances of survival are ensured by a better pre hospital treatment decisions and formulation of advance treatment protocols.

Advanced features or future enhancements

1. The requesting device (RD) could have advanced ways of communicating through screen touch the following details :-

a) The number of victims.
b) The severity of injuries to each one or all in general.

2. The hospital sub-system of AiO can have the hospitals graded as trauma centre grade I, II and III and based on the inputs from the RD and based on severity of injuries guide the ambulances/rescue vehicles (ARV) to the corresponding graded hospitals or HTC's.
3. An online health record (OHR) or a real time health status (RTHS) system can be devised in the ARV's to transfer the patients data to the hospitals or trauma centers of proposed shifting. This can work as a two way system:

a) Give best line of support system to the ambulance crew from the hospital.
b) The hospital will prepare in advance the line of treatment, arrange for specialist, operation theater etc. to save time and help save precious lives.

4. Green corridors could be designated for quick transfers. The green corridors in future may not be static but dynamic and can use real time traffic plans on routes and give navigation guides to the ARV's from accident site to the hospitals.
5. Google maps can be put on the user side applications (RD's) so that the real time arrival and location of the RAV's can be seen by the victims and act as a reassurance to the victim that help is on the way.
6. Internet protocols can be developed which could transmit digital information (voice messages, pictures and videos) seamlessly in the proposed system

The extended version of the project on a larger scale can be utilized for other forms of disasters both natural and manmade and be deployed for other life threatening emergencies.