VISE: Vehicle Identification Service in Emergency

Karishma Shaik[1] Sai Susmitha Velaga[2] Naseema Shaik[3] Hashmat Shaik[4]
Krishna Prasad Satamraju[5]
[1,2,3,4]U.G. Student [5]Assistant Professor
[1,2,3,4,5]Department of Electronics and Communication Engineering
[1,2,3,4,5]Vasireddy Venkatadri Institute of Technology, Namburu (V), Guntur (dt), Andhra Pradesh, India

Abstract— In this project, we develop a system called Vehicle Identification Service in Emergency (VISE) that helps in efficient time utilization during golden hour. The Golden Hour (also known as golden time) refers to a time period lasting for one hour, or less, following traumatic injury being sustained by a casualty or medical emergency, during which there is the highest likelihood that prompt medical treatment will prevent death. The process involved in the traditional emergency services will waste most of the time during golden hour and hence results in deaths of accident victims. Using VISE, we can effectively utilize the emergency services like ambulances, police or fire brigades thereby saving time and precious life of the accident victims. We use NodeMCU microcontroller and a GPS module in developing the system.
Key words: Vehicle Identification Service in Emergency (VISE)

I. INTRODUCTION

India is the second largest country in the world in terms of population. With such huge population, there is a need for proper emergency service system in India. Unfortunately, there is no single emergency management service system that could manage all the emergency services. A fragmented emergency system do exist in the country where there are different numbers for ambulances in 28 different states and 7 union territories and each hospital has got a separate number for its ambulance services. This fragmented emergency service has failed terribly with the increased demand for services. Therefore, there is a need for a proper emergency service that can be accessed by the general public from anywhere and at any time.

The strategic components of area-based development in the Smart Cities Mission are city improvement (retrofitting), city renewal (redevelopment) and city extension (Greenfield development) plus a Pan-city initiative in which Smart Solutions are applied covering larger parts of the city. Below are given the designs of the three models of Area-based smart city development.

Retrofitting will introduce planning in an existing built-up area to achieve smart city objectives, along with other objectives, to make the existing area more efficient and liveable. In retrofitting, an area consisting of more than 500 acres will be identified by the city in consultation with citizens. Depending on the existing level of infrastructure services in the identified area and the vision of the residents, the cities will prepare a strategy to become smart. Since existing structures are largely to remain intact in this model, it is expected that more intensive infrastructure service levels and a large number of smart applications will be packed into the retrofitted smart city. This strategy may also be completed in a shorter time frame, leading to its replication in another part of the city.

Redevelopment will effect a replacement of the existing built-up environment and enable co-creation of a new layout with enhanced infrastructure using mixed land use and increased density. Redevelopment envisages an area of more than 50 acres, identified by Urban Local Bodies (ULBs) in consultation with citizens. For instance, a new layout plan of the identified area will be prepared with mixed land-use, higher FSI and high ground coverage. Two examples of the redevelopment model are the Saifee Burhani Upliftment Project in Mumbai (also called the Bhendi Bazaar Project) and the redevelopment of East Kidwai Nagar in New Delhi being undertaken by the National Building Construction Corporation. Greenfield development will introduce most of the Smart Solutions in a previously vacant area (more than 250 acres) using innovative planning, plan financing and plan implementation tools (e.g. land pooling/ land reconstitution) with provision for affordable housing, especially for the poor. Greenfield developments are required around cities in order to address the needs of the expanding population. One well known example is the GIFT City in Gujarat. Unlike retrofitting and redevelopment, Greenfield developments could be located either within the limits of the ULB or within the limits of the local Urban Development Authority (UDA).

Pan-city development envisages application of selected Smart Solutions to the existing city-wide infrastructure. Application of Smart Solutions will involve the use of technology, information and data to make infrastructure and services better. For example, applying Smart Solutions in the transport sector (intelligent traffic management system) and reducing average commute time or cost of citizens will have positive effects on productivity and quality of life of citizens. Another example can be waste water recycling and smart metering which can make a huge contribution to better water management in the city.

Our solution will fit into the development of Pan-Cities. Providing Emergency Medical Services to the general public is the responsibility of the government and our idea will definitely help them in bringing emergency services accessible to the public.

II. EXISTING SYSTEMS

It is terms like ‘The Golden Hour’ and the ‘Platinum Ten Minutes’ that typify the importance of Emergency Medical Services (EMS) all over the world. It is a well-accepted fact that a patient who receives basic care from trained professionals and is transported to the nearest healthcare facility within 15-20 minutes of an emergency has the greatest chance of survival. EMS is an essential part of the overall healthcare system as it saves lives by providing care immediately. It’s this recognition that has led to research and development in EMS. Over the years several advancements have been made and research is underway to create services that provide medical assistance to patients at the earliest.

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However, the state of EMS varies drastically from developed to developing countries like India. In spite of the development in the healthcare sector over the past decade, India is yet to create a single, comprehensive EMS that can be accessed throughout the country.

In spite of the work going on in the area of EMS, still it is not meeting the requirements. Though there has been a considerable improvement in emergency services in India, but there is still a long way to go before a comprehensive EMS is implemented across the country. The available emergency services are not sufficient to meet the demand as one ambulance is needed to cover a population of 50,000 to 100,000. Still numerous deficiencies exist in the emergency services across the country. Therefore, India should have far more accessible and reliable emergency medical services irrespective of geographical factors. Another important component missing in the current system, and one that will be needed in the long-run, is a body to regulate the EMS in the country. LSAS in Mumbai claims that it had saved 22,000 lives in three years while EMRI in Hyderabad claims saving 55,000 lives in one year. But there is no way to validate these claims and introduce corrective measures.

Fig 1 shows the existing scenario in India. In case of an emergency, such as an accident, a person has to first make a call to the emergency service such as 108and then location information is communicated to them. Then the operator at the service center will locate the ambulance services nearby that location and then pass on this information to the driver of the ambulance. This process will consume more than 20 minutes of the Golden hour.

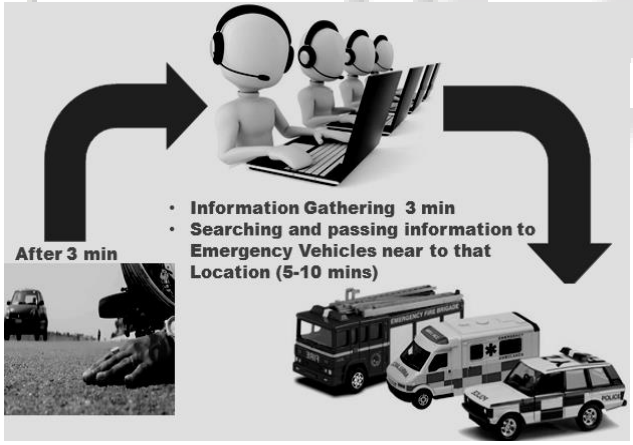

Fig. 1: Existing Scenario in Emergency Services

As per a survey, the average time taken by an ambulance to reach a location in a major city is approximately 20 minutes. During peak hours, it may take even longer time. In emergency medicine, "Golden Hour" refers to the immediate one-hour time period following a traumatic injury, during which, chances of preventing death by way of prompt medical treatment are the highest. The phrase was first introduced when soldiers were being provided with emergency medical aid at the close of World War II and the Korean conflict.

When it comes to providing emergency medical services to road crash victims, there is a similar connotation as indicated by countless studies. They indicate that the single most prevalent cause of death for road crash victims is blood loss, mainly from failing to provide life saving treatment immediately to the victim, which illustrates the vital need for institutional preparedness supported by an emergency response mechanism.

The first death from road crash was recorded in 1896. It was said at the time that "this must never happen again." But more than a century later, the World Health Organisation's (WHO) data shows that 1.25 million people are killed from road accidents every year and as many as 50 million are injured. Road accident ranked the 11th leading cause of death, accounting for 2.1 percent of all deaths globally and the second leading cause among people aged 5-29.

But challenges for managing the "Golden Hour" are enormous, starting from getting timely information about the crash itself to responding quickly and properly. Unfortunately, both private and public hospitals in South Asia, including in Bangladesh, are negligent in providing emergency services to road crash victims. Additionally, bystanders who could render help to survivors fear legal consequences, harassments and repeated police interrogation which makes them reluctant to act as Good Samaritans. Worldwide, there is legislation to protect the Good Samaritan which we are yet to adopt.

Challenges and Opportunities Quality of health care concepts emerge from our understanding of goals of health care. The primary goals of any health care service include: improvement of health of the population, responsiveness to felt needs of the people and financial protection against costs of ill-health. Health would include survival and quality of life. Responsiveness is about the interpersonal aspects of care. It refers to client orientation and respect for persons. The health enhancing aspects of care has been referred to as technical quality of health care, and the responsiveness dimension has been referred to as interpersonal quality of care. Financial protection refers to equity aspect of the health system. Newbrander and Rosenthal refer to similar aspects of health care as the social aspect of quality, for example, efficiency and access. Evidently, quality of care is a multidimensional concept consisting of objective and subjective elements. Hence quality of care is inferred from a variety of sources. In this section we discuss some of the key elements that has a bearing on the quality of emergency health care in India.

Access to Health Care Quality of Emergency Care is to a large extent, reflective of the overall performance of the health sector. It is universally accepted that the functioning of the public health sector in India is far from satisfactory. The National Health Policy, 2002, states that; "It would detract from the quality of the exercise if, while framing a new policy, it is not acknowledged that the existing public health infrastructure is far from satisfactory. For the out-door medical facilities in existence, funding is generally insufficient; the presence of medical and para-medical personnel is often much less than required by the prescribed norms; the availability of consumables is frequently negligible; the equipment in many public hospitals is often obsolescent and unusable; and the buildings are in a dilapidated state.

In the in-door treatment facilities, again, the equipment is often obsolescent; the availability of essential drugs is minimal; the capacity of the facilities is grossly inadequate, which leads to over-crowding, and

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consequentially to a steep deterioration in the quality of the services". The health care system is inequitable with marked disparities in access to health care, particularly related to location, socioeconomic status and gender of the population. Over 66% of hospitals and 77% of the hospital beds are located in urban areas. Rural areas have 0.77 hospitals, 1.37 dispensaries, 3.2 PHCs and 44 beds per lakh population, while urban areas have 4.48 hospitals, 6.16 dispensaries and 308 beds per lakh population. The urban-rural disparity is more evident when one considers that more than 70% of the Indian population resides in urban areas. In 2001 of all registered hospitals 72.52% were in the private sector and 27.47% in the public sector. The private health sector accounts for over 70% of all primary care, which is sought, and over 50% of all hospital care. This is not a very healthy sign for a country in which three-fourth of the population lives at or below subsistence. Given the above characteristics of the Indian health care system, it is not surprising that there is a gross disparity in emergency care delivered to paying and non-paying populations and between urban and rural settings of the country. In recent years there has been some efforts by central and state governments to improve access to emergency care in the country. Provision of Emergency Obstetric and New Born Care Services through PHCs and first referral units has received much attention under the RCH programme.

The Central government has initiated a scheme to enhance and upgrade the accident and emergency services in select State government hospitals falling in the accident-prone areas of the national highways. Under the Sanjivani scheme to provide emergency health care in times of disaster, the central government has acquired container based mobile hospitals, which can be transported by rail, road or by air and be set up at or near the disaster site at short notice. Once installed, it would be a hospital with 200 beds with operation theatre and diagnostic facilities including CT scan. The First Referral Health Systems Project being implemented with support of the World Bank in states such as AP, Maharashtra, Orissa, Punjab etc., aims to improve emergency medical services as a key component of the overall health programme. State government initiatives to ensure 24 hour availability of staff1 and provision of telephones at PHCs2 are bound to improve access and quality of emergency care at PHCs. There has also been some efforts by Apollo Group of Hospitals in the private sector, Delhi Metropolitan Corporation in the public sector, the Neurological Association of Bangalore in the nonprofit sector etc., to improve on the site and pre-hospital emergency care. Air ambulance services are also available for paying patients in other parts of the country. While these initiatives appear promising, majority of the population, especially in rural and remote areas of the country do not have access to emergency care due to lack of pre-hospital emergency care and transport, limited hospital resources, and an absence of integrated and organized emergency care systems. There is general agreement among public health experts that some capacity for emergency care should exist at every level of the health care system.

Service	Private				Public		
	Clinics	Small Hospitals	Big hospitals	All	PHCs	Small Hospitals	Big Hospitals
Number	71	69	10	150	53	41	12
Telephone	79 %	96%	100 %	88 %	6%	41%	92%
Ambulance	6%	23%	80%	19 %	26 %	34%	92%
Blood Bank	0%	6%	60%	7 %	0%	0%	33%
24 Hr EMS	11 %	67%	80%	41 %	25 %	59%	67%

Table 1: Findings of Healthcare Institutions in Andhra Pradesh

However in India, there is a gross lack of resources to manage the range of emergency clinical problems that are encountered on daily basis, at every level. Mahapatra and Berman observed that about 40% of first referral public hospitals (secondary level hospitals) in Andhra Pradesh did not provide any kind of emergency service. Findings of a recent study in Andhra Pradesh, as shown in Table 1, reveal that health care institutions fare poorly even for the most basic indicators of accessibility of emergency health care such as connectivity by telephone, availability of ambulance services and 24 hour emergency services.

III. SYSTEM MODELLING

As shown in Figure 2, VISE comprises of two modules. Under Hardware, we have a controller to which a GPS module is attached. The Vehicle Type, Vehicle Number, Driver Mobile Number are pre-programmed in the controller. GPS module provides the latitude and longitude information of the vehicle location at any instant of time. To make life easier, we incorporated a status switch in the system which indicates whether the service vehicle is already in use or free. This allows the application users to view only those services that are free and ready to serve. This entire information is stored on a cloud database to make it available for anyone, from anywhere and at any time. We have used Firebase database from Google Cloud services to store the data from the vehicles.

We have used NoeMCU microcontroller and Ublox NEO-6M GPS Module to design the working model of the system and this module is shown in Fig 3.

The design flow of the application is follows Select the type of service required and Click on GO. Immediately, all the service vehicles that are free and which are in and around the accident location will be displayed on the screen. Upon selecting appropriate vehicle, information such as Vehicle Type, Vehicle Number, and Mobile Number of the driver will be displayed.

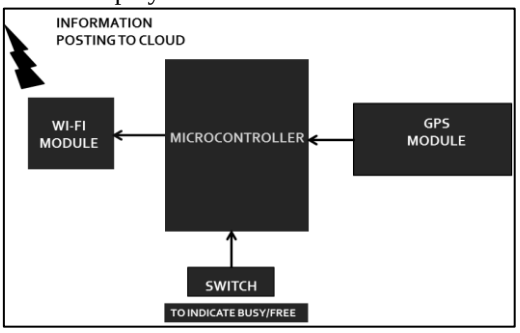

Fig. 2: Block Diagram of VISE

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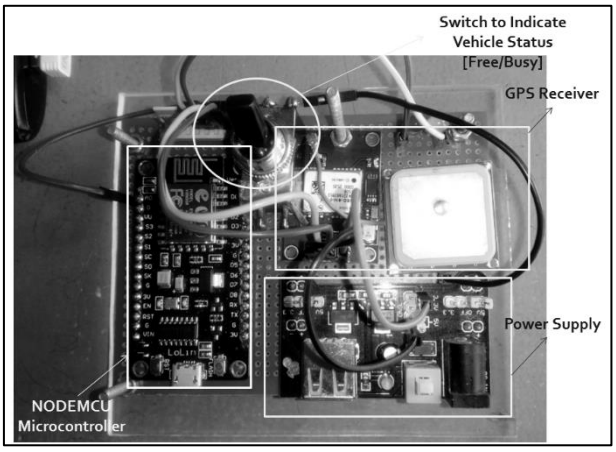

Fig. 3: Working Prototype of VISE

The Results Were Shown in Fig 4 to Fig 7 and are Self-Explanatory.

Fig. 4: Menu Displaying the Available Services

Fig. 5: Ambulance Service Selected

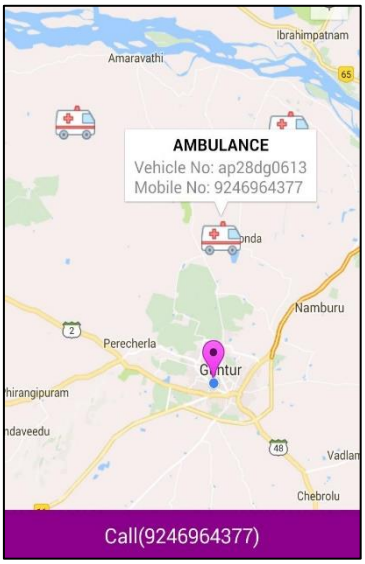

Fig. 6: Google Map Displaying Ambulances Available Around the Current Location

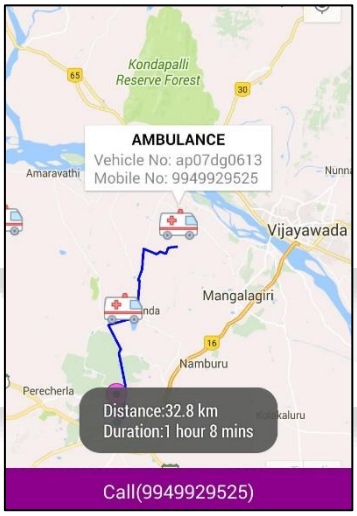

Fig. 7: Distance and Time Information of Vehicle to reach the Current Location

We need not give any information about the location and driver can reach the location based on the GPS. Once the suitable vehicle is identified, the user can press the CALL button that directly connects him to the ambulance driver. The driver also receives the GPS location of the called person and he can directly reach the location.

IV. CONCLUSION

We have designed Vehicle Identification Service in Emergency (VISE) to address the problem of identifying the emergency vehicles during accidents. With the existing centralized emergency service provided by organizations such as 108, most of the time is wasted in communicating accident location details and sharing these details with ambulance driver. By the time the driver reaches the accident spot, most of the precious time will be wasted. A complete hardware and software solution is provided through VISE. The hardware module can be installed in the emergency vehicle and this gives the location information and vehicle

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details as well as the mobile number of the vehicle driver. The software part of VISE is a Mobile/Web application that shows the users the available emergency vehicles in and around the present location along with their distance and time to reach the present location. This becomes handy in accident situations to access emergency vehicles and save lives. With major cities in India transforming to Smart Cities, this solution helps the authorities to provide a faster access to the emergency services.

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