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COORDINATING AN UN-ADMINISTERED AND SELF VOLUNTEERED CRISIS MANAGEMENT IN TRAINS WITH SMARTPHONES IN INDIAN SCENARIO

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With a huge number of passengers travelling each day, the Indian railways face a major challenge in providing safety and security to all its passengers. Our analysis on the Indian Railways suggests that it is not practical to keep track of emergency situations on route, such as a medical assistance. Any additional effort towards overcoming such serious situations becomes significant burden for Indian Railways. Hence, it requires that, without much change in the system, there should be a way, through which passengers in a train helps among them to ensure safety and security of each other. In this scope, we propose a robust solution with a mobile-based application, which maintains a proper outflow of communications for the passengers caught in the emergency conflicts. The application sets a platform for the railway passengers to coordinate and care among themselves and helps the users to mitigate emergency with effective management. It results in a lot more better condition for passengers to board the train. In this paper, we describe the implementation method of this system and its implications.

Keywords: Crisis management; disaster avoidance; emergency response; mobile security application; railway passenger safety.

1991 Mathematics Subject Classification: 22E46, 53C35, 57S20

1. Introduction

Emergency management encompasses activities like training, preparation, planning, response and recovery. It is illustrated that a structured and coordinated management is a

fundamental resource to mitigate emergencies. Different people have different methodology to approach an emergency. According to Ref. 1, one out of five passengers feels unsafe while travelling in trains. In Britain, it is noticed that in a period of twelve months, 11% of passengers report being stared at in a hostile or threatening way and 12% report of being pushed or similarly assaulted.

India, the second most populous country in the world, is experiencing a major shift in the proportion of working age population. In the research portrayed in Ref. 1 in 2003, it is indicated that 2.06 billion people travel every year in the trains, and is expected to rise by 25% by 2010. With so many passengers on board, the railways find it difficult to maintain security and safety for everyone. According to the estimates, the Indian Railways is the largest rail passenger carrier in the world. In pre-budget economic survey conducted on 2014 (Ref. 3), India's working age population is expected to rise from 58% in 2001 to 64% by 2021. As a percentage of GDP, the expenditure on education has also gone up by 0.4% from 2009. With such increased figures, the dependency of the people on trains in terms of work requirements, job hunting etc. has increased to the greater extent (Ref. 4). Students studying at colleges outside their states are found being dependent on train, as it provides them the cheapest and the convenient fare for long duration journey.

The railways have experienced many major accidents due to derailment or collision between the trains in the past year, causing several human causalities and large scale disruptions in traffic. Many times, medical help required at that point in time gets delayed because of inaccessibility of the accident region. In addition to it, there are a number of incidents that are happening in everyday train travel, which should be resolved before it gets worse. Some examples of such incidents can be a heart attack, dispute between passengers, teasing of women and child abuses. In our knowledge, there is no record exists on how many of such events have risen during the train ride in the past years.
Safety and security issues can arise in multiple ways during a train ride. A passenger who is travelling alone and gets ill in the middle of the night, a conflict between two co-passengers, an accident which can bring death to many living hearts are the situations which are very common for passengers who travel regularly. At present, there is no opportunity to the passengers to fight back the situation. These are the daunting situations where a passenger founds himself restricted and he tends to accept the situation as his fate.

There are at times when students, senior citizens or single individuals travel in trains with more than a day long journeys. In such long journeys, different people from different states, different languages board the train, hinders the ease of communication between individuals. In such a situation, when a passenger is caught with a conflict or the health problem, the communication barrier makes it difficult to get help from a police officer or a doctor in the train.

In this scenario, we propose a novel and effective system with the help of a mobile smartphone. In India, the mobile phone is becoming more popular and widespread device. The technology and new generation smart phones are well accepted by common people. A basic mobile phone with all android features is readily available in market within the price range of 5000 Indian Rupees (INR), or 75 US$ approximately. Since they are simple to use and its benefits are multi-folded, it can be used as a tool to implement security and safety of the passengers. The implementation of our idea can bring a ray of hope to thousands of souls who keep on panicking in situations, which are out of their control.

This paper aims at dissipating the emergencies for the passengers of train by using every possible resource available. It demonstrates the significant role of communication between the passengers and available resourceful persons in train to mitigate these conflicting situations. In our best belief, our approach is unique and novel, and can perfectly suits for Indian railway commuters.

This paper is organized as follows: In Section II, we discuss the summary of related articles found in the published literature. In Section III, the design considerations of our system are provided. A working model of the system is narrated and illustrated in Section IV. In Section V, the communication mechanism implemented for this system is described. In Section VI, a discussion on the advantages of our system in the context of Indian Railways and the drawbacks of the system are mentioned. Finally, the paper is concluded in Section VIII.

2. Related Works

The published literature related to our works provide help only in case of mass emergency from the external sources (Refs. 5 and 13), while our application allows every individual to get help from within the internal source, i.e. from within the passengers of the train. The complexities in rescuing the passenger from the emergency, as discussed in Ref. 6, is bare minimum with our proposed system. The SMS facility used in Ref. 7, is the most reliable form of notification we can expect in trains where network is not clear. The application notifies all the doctors, police officials and railway officials present in the train, so that whenever there is traffic of emergency cases as in Ref. 3, things can be resolved easily.

According to Refs. 2 and 10, the Swedish Icomera, founded in 1999, pioneered the wireless Internet industry to become the first provider in the world, to trial the broadband Internet onboard trains with experiments on the Linx trains running services between Gothenburg and Copenhagen. The Chinese and Indian railway passengers also got Internet access, provided by RailTel, a telecoms infrastructure agency of the Ministry of

Railways. Currently, In India the train "Howrah - New Delhi Rajdhani express" and "Gatiman express" give every passenger an opportunity to access internet on-board.

According to the study in Refs. 8 and 14, exercises, drills or simulations are widely used by the people to stimulate and train on the exact kind of the incidents, such as a bomb blast and derailment. In Ref. 9, a knowledge based system named as Mobile Emergency Triage (MET) is developed an m-health application that supports emergency triage of various types of acute pain. This system is designed to use in the hospital to train physicians in disposition of their quick decision. Though there are various training games available to train person in an emergency, yet situation like sickness of a passenger, conflicts among passengers travelling in train is being neglected. Our system considers people in these conflicts as major priority, and with the optimal communication, helps them to respond to the situation quickly and effectively (Ref. 12).

3. System Design

In the present state of art, the emergency response system in trains is available only in case of the mass emergency, while our application focuses on the needs of the individual, and helping every individual in case of an emergency. We propose a system, which when used in an emergency or in a conflicting situation, can reduce the high level of risk that a passenger may face. The system includes an Android mobile application, which uses various communication technologies to provide the best possible help to the passengers in case of an emergency.

Our idea is to unite every single person who can help at that point in time to fight against the conflict. The railway officials, doctors, the army soldiers and on-duty police officials travelling in the same train can take charge at the time of conflicts. The application provides all time access to the people, who can voluntary registers themselves with our mobile application while boarding the train. They can act courageously supporting other passengers not to panic at the time of conflicts. The mobile application demonstrates the role of different individuals, capable of dealing with the conflict with better experiences.
The system comprises of an Android OS based mobile smartphone, with "My-NEED" mobile software application pre-installed in it. The mobile should also have internet access at any point in time to use the application properly and efficiently. The efficiency of this system entirely depends upon the interaction between the user and the officials present in the trains that can solve the emergency conflict within the time limit.

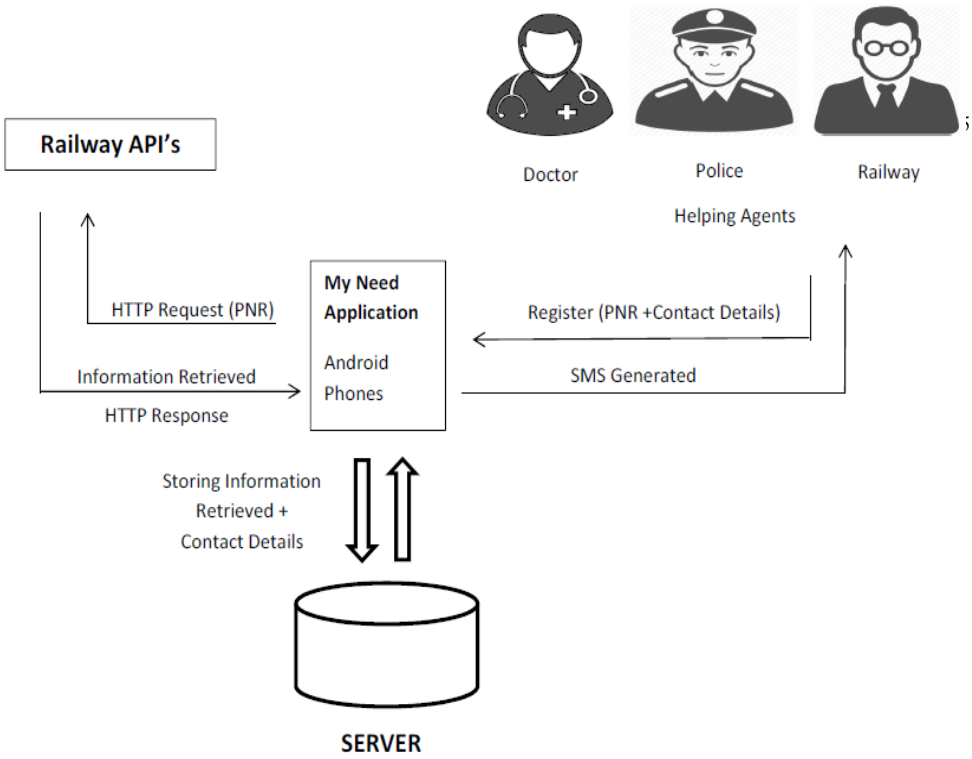


Fig. 1. An illustration of the types helping agents and their registration process with the proposed system

Fig. 1 illustrates the overall system and type of users associated with the proposed mobile application. The application includes a backend server, user interface for passengers, doctors, police officials, railway officials, and social workers. The user interface provides the PNR number (Passenger Name Record, a unique ten digit number assigned to each reserved ticket by Indian Railways) to the application, through which the system retrieves details like travel date, train number, coach number, seat number, source station and destination station, and stores it in the database maintained at the backend server.

The application focuses on self-serving the emergency needs of the individual passengers, which significantly reduces the burden of the administrators and the railway management. It leads to increase in trust among the passengers on the same train, which in-turn increases the safety aspects for women and other affected people.

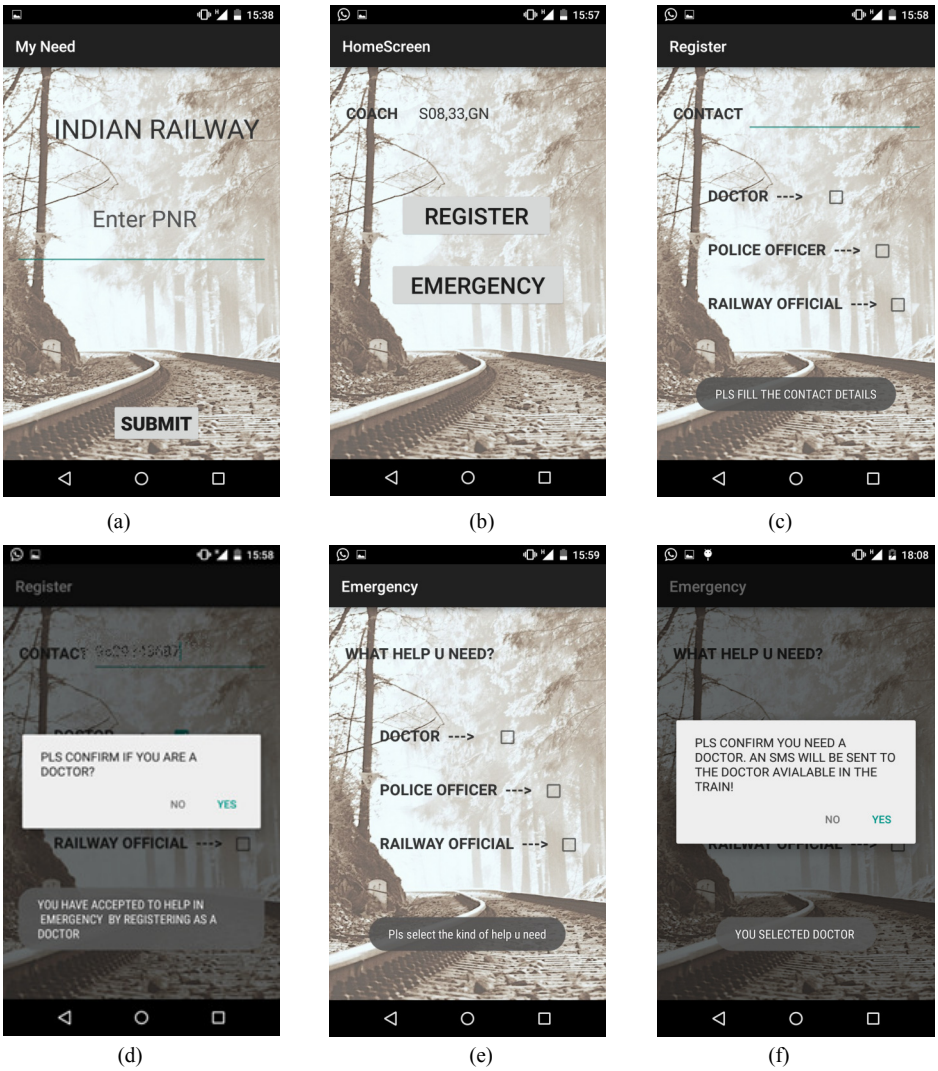


Fig. 2. The mobile application screen shots. a) Application home screen b) User home screen c) Voluntary registration window for doctors, police and railway authorities d) Confirmation of designations with the user e) Pre-defined menu items for type of emergency situation f) Emergency situation confirmation

The mobile application has two main interfaces, Register View and Emergency View, as shown in Fig. 2(b). The Register view, shown in Fig. 2(c), is for the passengers, doctors, on-duty police officials, army soldiers, police officials, railway officials, etc., who can voluntary register on the application by selecting their occupation and providing some additional details. The system retrieves the details like destination station, source station, train number, seat number and coach number from PNR entered, occupation from the user selected menu, and contact number from the entry field provided in the mobile application. The system stores these details in the backend server for future processing. Before the information gets stored, each user gets a confirmation alert, where they have to accept the terms and conditions to help in case of emergency, as shown in Fig. 2(d).

The Emergency view, shown in Fig. 2(e), is for the actual passengers who are under a threat or immediate medical assistance, to get emergency help. On encountering an emergency, the passenger logins to the application with active PNR, and clicks the emergency button. The user selects the kind of help he wants from a pre-defined menu items. Up on confirmation, refer Fig. 2(f), a message is generated and forwarded to other parties automatically. The message comprises the user's coach number and seat number, and is send to the corresponding helping agents with respect to the type of help required. For example, a medical emergency request is forwarded to doctors on the train; a safety alert is forwarded to the registered police officers in the train.

4. Working Model

Generally these days, whenever there is an emergency in trains, the help is provided from the outsourced agents, which takes a lot of time to arrive. In our proposed method, the help is provided from the inner source i.e. from within the train. Based on the situation, the voluntary helping agents have to take the charge to handle the conflicts. They are expected to resolve the conflict as early as possible. It is a pre-step that a passenger travelling in train can take before arranging help from an out-source agent.

In this section, we demonstrate how our system works in real life. The "My Need" application is a common interface for general passengers and helping agents. In Fig. 3(a), the startup screen is shown. Here, every user has to enter his / her PNR number, as shown in Fig. 3(b). Once the PNR number is entered, the application automatically seeks the passenger details and displays it in the next screen, as shown in Fig. 3(c). For a general passenger, that is all he should do before start of his journey. For doctors, police officers and railway officers, who are interested in helping the other passengers in their needs, can register the profession with this application. They follow the normal procedures as used by the other passengers, from Fig. 3(d) to Fig. 3(g). They provide their profession and contact number to get emergency situation message by choosing the register option, as shown in Fig. 3(f).

Whenever a passenger faces an issue, he chooses the type of emergency, as given in Fig. 3(h), and then confirms it, as shown in Fig. 3(i). The SMS is send from the passenger mobile, shown in Fig. 3(k), and is received at the helping agent's mobile, as shown in Fig. 3(l). The help can be offered at the best possible time to the passenger, with the available information in the message, such as coach number and seat number of the passenger.

Fig. 3. The sequence of events in a typical emergency situation is given as screen shots. a) A lady passenger accesses "My Need" application b) The passenger enters her PNR number c) The passenger's coach number and set number are correctly displayed in the application d) Another passenger, who is also a doctor enters his PNR number e) The doctor wishes to help during an emergency f) The doctor registers with "My Need" application g) Confirmation message to the doctor h) An emergency situation occurs with the passenger, and she decides to call for a doctor i) The passenger confirms her emergency j) The application search for the availability of a doctor in the train k) Money is deducted from the passenger mobile to send SMS to doctor l) The SMS appears in the doctor's mobile phone

The "My Need" app signifies the safety and security concerns of an individual passenger while boarding the train. To login to the application, the user should have the ten digit active PNR number, as shown in Fig. 3(b). The system uses the PNR number to fetch the passenger details from the Railway API (Application Programming Interface). Details

like train number, date of travel, coach number, seat number, boarding station, and destination station are fetched from the API.

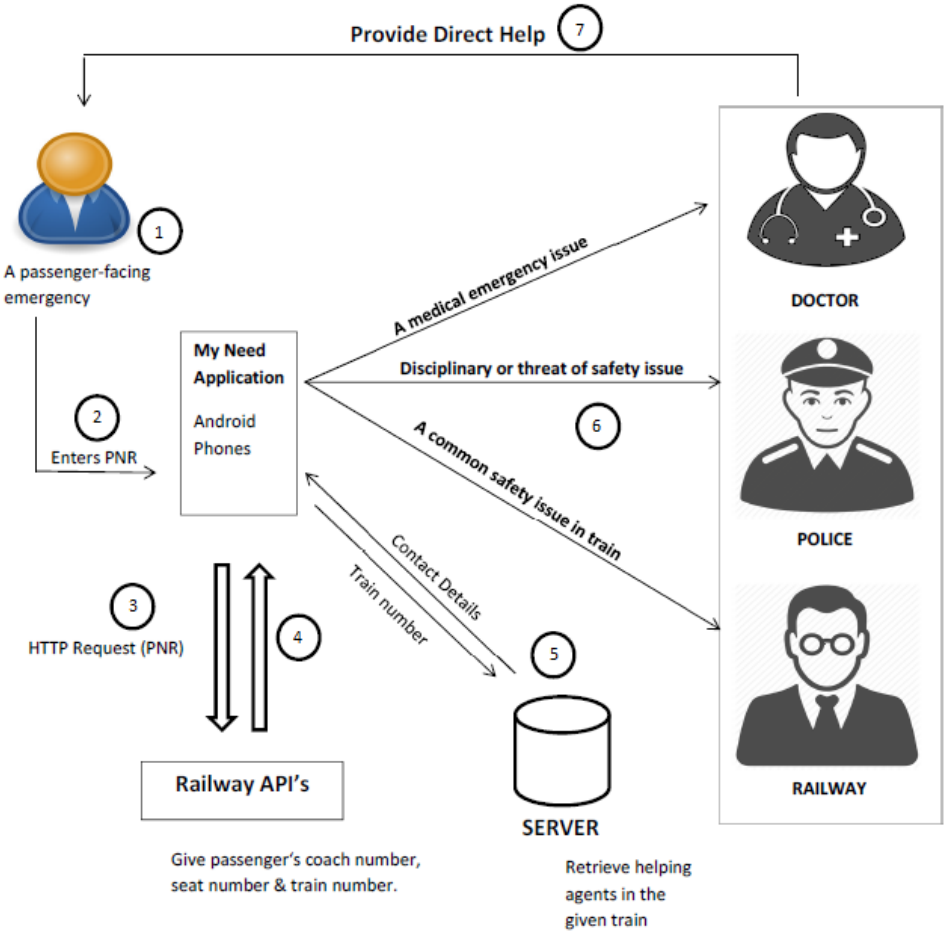
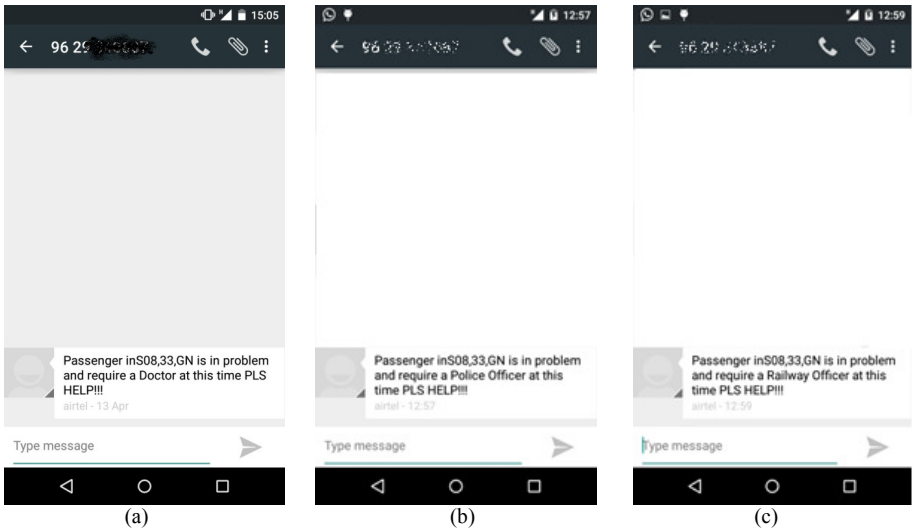


Fig. 4. An illustration of communication between the participants is given above. 1. A passenger feels uncomfortable and decides to get help for the issue. 2. The passenger initiates emergency from his "My Need" mobile application. 3. The mobile application takes the passenger PNR number and use the railway API. 4. Using the API, it queries the railway server. 5. The server returns the passenger details (coach number and seat number) and contact information of available helping agents in the train. 6. The mobile application identifies the type of issue faced by the passenger, and frames an automated message to forward it to the corresponding helping agents. 7. The helping agents receive the message and approach the passenger location to offer help.

5. Communication Mechanism

The communication between the passengers and the helping agents plays a major role in our system. The effective secure communication, as in Ref. 11, between all of them can help to resolve the conflict within the best possible time limit. An illustration of effective



(a) (b) (c)

Fig. 5. Emergency message formats. a) For a medical emergency issue b) For a personal safety related issue c) For a public threat or a common issue

communication mechanism implemented is shown in Fig. 4. A typical message generated by the application is shown in Fig. 5.

In our proposed method, everybody needs to understand his or her role and be the part of the system. One should be quick enough in his / her responses for the proper outflow of the system. We presume that people participating in our safety system are willing to take risks and responsibility to attend the emergency situation without any external pressure. If the response gets delayed, the situation may become worse.

6. Discussion

A smartphone with "My-NEED" application acts as a safety-device, which portrays counter measures for the conflicting situations, for the benefit of the passengers. The system supports the passengers of train to react with immediate effects to the situation. It acts as a key source to unlock the potential resolution within the available resources. With this system, the passengers feel safe while boarding the train, which results in a more joyful ride.

This application aims at dissipating the emergencies for the passengers of train by using every possible resource available. It demonstrates the need for effective communication between the passengers and available resourceful persons to mitigate conflicting situations. The application also features to take the information of the passengers who voluntary register as helping agents. The automatic message is sent to all the people registered under the particular help during an emergency, so that all of the concern person in the same train can respond and best effective solution can be brought out of a conflict.

We have identified the following advantages for the method:

- No dedicated administrators required to run the system.
- The application is based on official railway API.

- My Need application act as a safety device with counter measures.
- Passenger's safety is prioritized during the long duration journey trains. They get all time access to doctors, railway authorities and police officials present in train.
- Reduces the burden off the railway authorities for passenger's safety, with increased benefits.
- Passengers themselves can mitigate emergency with effective management.
- The application does not reveal any identity of the doctors, railway officials or police officials present in the train, to the co-passengers.
- The help to the passengers in emergency is provided voluntarily by the co-passengers, which is the key attraction in our method.

The following drawbacks are identified in the system:

- The application is entirely based on Indian Railway Servers, which are down from 11.30pm to 12.30am.
- The application is based on railway API, which gives free credentials for only ninety days for 100 hits per day. At later stages, when our application requires more hit then we can upgrade the account by paying Rs.600 for every three months and we get 10,000 hits per day.
- It also requires internet access to get a help in case of emergency in trains.
- Cost of SMS and internet connectivity is to be handled by the participants.
- Internet connection may not be available at the time of emergency to download the application and register. Strong public awareness required to pre-install the application and register the PNR number each time a person board the train.

Conclusion

With a strong motive to provide a proper emergency management to the passengers of the train, we came up with a feasible system with some basic fundamental and structured steps, which can ensure security of the train passengers while they are on board. The system acts in the favor to decrease the level of the crime related conflicts in the train. It also leads to immediate medical attention to the needy at the earliest possible time. As there are thousands of daily train travelers in India, we expect that our system can provide a platform to exercise mutual caring and protection among all passengers. Above all, this system is not a burden to any authorities. It is a simple way to promote mutual coordinated support among all passengers in the train.

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