# LEAN START-UP MANAGEMENT

(MGT1022)

# DIGITAL ASSIGNMENT – 1

**SUBMITTED TO:**

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**TEAM 5**


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**Q1. In the month of December 2021, the front wheel of an over speeding SUV, hit the median in a highway, rolled over twice and fell on a two-wheeler in the opposite lane, killing two youngsters on the spot. Using Design thinking principles design an innovative solution to avoid such accidents in future.**

## 1. Introduction

Over the past few decades, the number of vehicles has significantly increased which has resulted in populated roads. This massive traffic load has uplifted the road accident graph, which has consequently raised injuries and death rates worldwide. There are many factors resulting in accidents i.e., in case of vehicle-vehicle collisions if either of the drivers is in a state of hurry or not attentive on the road , it can lead to fatal accidents. In the past we have seen a rise in the number of private vehicles being owned by the public. This has led to congestion on roads in metropolitan areas which cause traffic jams and eventually resulting in traffic accidents. Traffic accidents occur for various reasons. While problems with roads or safety facilities lead to some accidents, the majority of traffic accidents are caused by drivers' failure to abide by regulations, consider pedestrians, and acknowledge dangerous behaviors.

A total of 4,37,396 road accident cases were reported during 2019. Road accident cases in the country have decreased from 4,45,514 in 2018 to 4,37,396 in 2019. The fatalities in road accidents have increased by 1.3% (from 1,52,780 in 2018 to 1,54,732 in 2019). Over 3.54 lakh road accidents in 2020; More than 60% due to overspeeding. India recorded 3,54,796 cases of road accidents during 2020 in which 1,33,201 people died and 3,35,201 were injured, the annual report of the National Crime Records Bureau (NCRB) showed. The NCRB data showed that 43.6% of victims of road accidents were riders of two-wheelers, 13.2% of cars, 12.8% of trucks, and 3.1% of buses, respectively. Dangerous or careless driving or overtaking contributed to 24.3% of road accidents which led to 35,219 deaths and 77,067 people being injured, it added. Only 2.4% of the road accidents were due to poor weather conditions, the government report added.

After analyzing the data recorded by NCRB we can conclude that most of the accidents on road were due to careless or dangerous driving in which the driver is either above the alcohol intoxication level or there was driving at high speeds.

The following literature survey focuses on the problems and solutions to avoid accidents in detail and lists out different approaches and their shortcomings which will be used to make an effective solution to reduce accidents.

## 2. Literature survey

| S.No. | Paper Title | Name of the Conference/ Journal, Year | Methodology Used | Disadvantages |
|---|---|---|---|---|
| **1.** | Smart Road Traffic Accidents Reduction Strategy Based on Intelligent Transportation Systems | A. Aldegheishem, H. Yasmeen, H. Maryam, M. Shah, A. Mehmood, N. Alrajeh, and H. Song, "Smart Road Traffic Accidents Reduction Strategy Based on Intelligent Transportation Systems (TARS)," *Sensors*, vol. 18, no. 7, p. 1983, Jun. 2018. | This research paper has highlighted the issue of road safety. Road hazards have drastically increased with the increase in automobiles over the last ten years.<br>The proposed protocol forecasts the probability of the occurrence of an accident in advance before it occurs. It also re-routes vehicle traffic to prevent traffic jams on the road that may cause accidents. | The solution proposed in this is based on the fact that the driver will pay attention to the alerts and notifications sent to them.<br>It does not take into account the accidents that may happen due to the drowsiness or drunkenness of the driver. |
| **2.** | Detection and prediction of driver drowsiness using artificial neural network models | Charlotte Jacobé de Naurois, Christophe Bourdin, Anca Stratulat, Emmanuelle Diaz, Jean-Louis Vercher, Detection and prediction of driver drowsiness using artificial neural network models, Accident Analysis & Prevention, 2019. | In this study, different Artificial Neural Networks were used either to detect a drowsiness level or to predict when a driver's state will become impaired. The best models used information about eyelid closure, gaze and head movements and driving time. | The proposed model can predict within 5 min when the driver's state will become impaired but eyelid and head movements are difficult to record in a real car, the focus should be on improving a model using only driving performance, driving behavior and physiological measurements. |
| **3.** | Risk factors in highway traffic accidents: a case control study | Martha Hı´jar, Carlos Carrillo, Mario Flores, Rafael Anaya, Victoria Lopez. ELSEVIER, 1999. | The objective of this study was to identify risk factors related to the driver, the vehicle and the environment, that are associated with motor vehicles accidents on | In spite of the fact that driving speed is a factor that determines the risk of accidents, as well as that of resulting injuries, it was |

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| | | | highways. Due to the highway's characteristics and legal aspects, the only way to interview the drivers was to do so with those who stop voluntarily. | eliminated from the analysis done in this paper. |
| **4.** | A Review on Road Traffic Accident and Related Factors | Muthusamy A P, Rajendran M, Ramesh K, Sivaprakash P. International Journal of Applied Engineering Research. Volume 10, Number 11. pp. 28177-28183 (2015). | This paper reviewed various factors and statistics related to road accidents occurring in various countries and also studies different safety measures suggested by researchers. The results of various field works done on the road traffic accidents in various countries have also been reported in this paper. | Multifaceted review of various literatures has shown that accidents occurrences are the effect of multiple human, vehicle and environmental elements often interacting in a complicated manner to generate the initiation of the event. However, to reduce RTAs, empirical details and various important statistics related to the road accident severity were neglected. |
| **5.** | Research on Highway Roadside Safety | Guozhu Cheng, Rui Cheng, Yulong Pei, and Juan Han. Hindawi Journal of Advanced Transportation. WILEY (2021). | This paper reviewed the different prediction methods and evaluation models for the frequency and severity of roadside accidents and carried out the statistical analysis of significant risk factors for frequent and fatal roadside accidents. | Although scholars in this paper have suggested some incredible ways of incorporating roadside safety, there is still a larger gap between the current research level and the actual application demand. A set of reasonable and effective roadside safety design method systems is still lacking. |

## 3. Methodology

Our proposed Road Accident Prevention (RAP) scheme is designed for preventing highway road traffic accidents on Indian express highways. The overall structure of the RAP scheme is presented in Figure 1.

If the driver of the vehicle is informed about the occurrence of an accident in advance, then the driver might take precautionary actions to prevent the vehicle from road accident. It is known that if the possibility of a road accident is predicted in advance, then it would be easier to perform prevention.

The design of RAP scheme constitutes four phases such as:

(i) Prediction Report (PR) construction phase
(ii) Emergency Warning Message (EWM) generation phase
(iii) Vehicular Backbone Network (VBN) formation phase and
(iv) EWM dissemination phase.

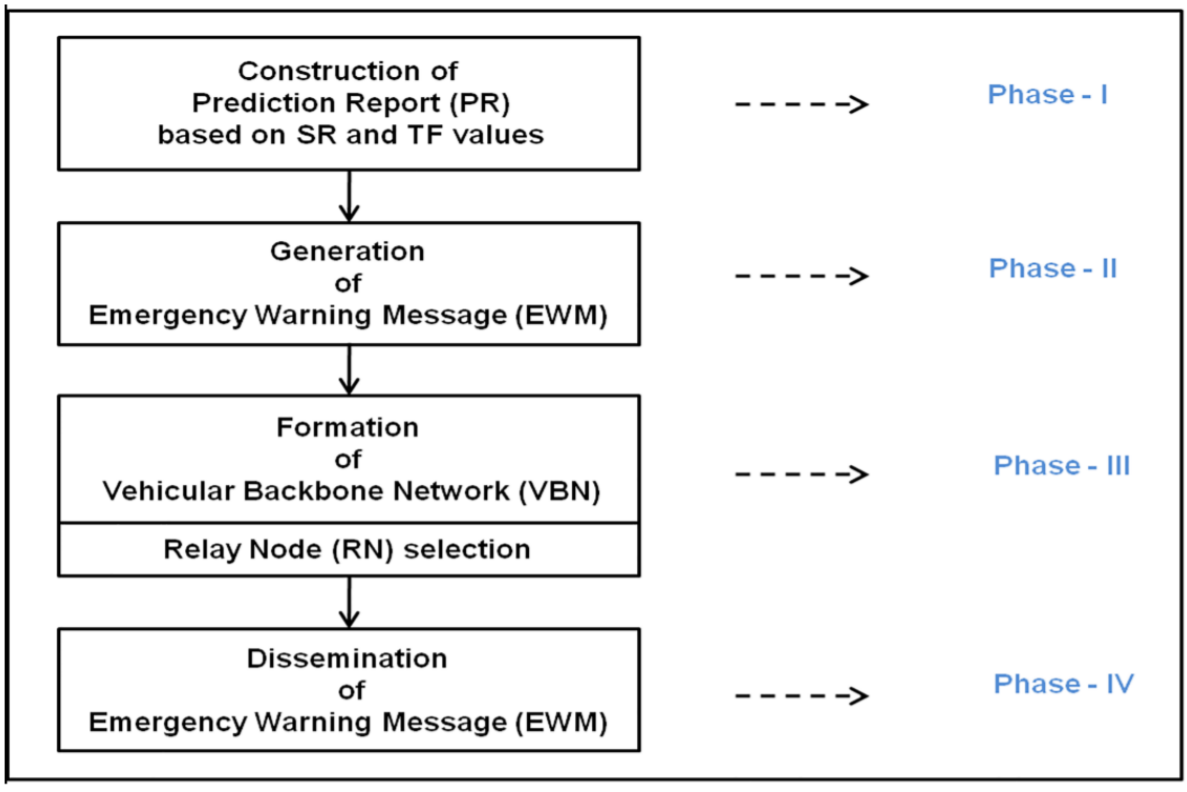



Fig. 1. Overall structure of RAP scheme

## 4. Diagrammatic Representation

Based on Indian four lane highways, the highway road we are considering consists of four lanes, two in each direction with a divider and follows the Indian traffic system (left hand traffic). These lanes are fixed with a minimum speed limit of 60 km/h and maximum speed limit of 90 km/h. If the vehicle travels at a speed of 60 km/h, then it resides within the coverage area of RSU (500 meters) for 30 seconds. On the contrary, if the vehicle travels at a speed of 90km/h, then it travels in the coverage area of RSU for a mere 19.8 seconds. The four lane highway is assumed to be embedded with sensors and it forms a Four Lane Sensor Grid (FLSG). The sensor coverage is found to be 6 meters and the vehicle is present within this area for 240 ms if it travels at a speed of 60 km/h. With respect to this, the periodic timer is set to the minimum value of 100ms for most of the control activities of the RAP scheme.

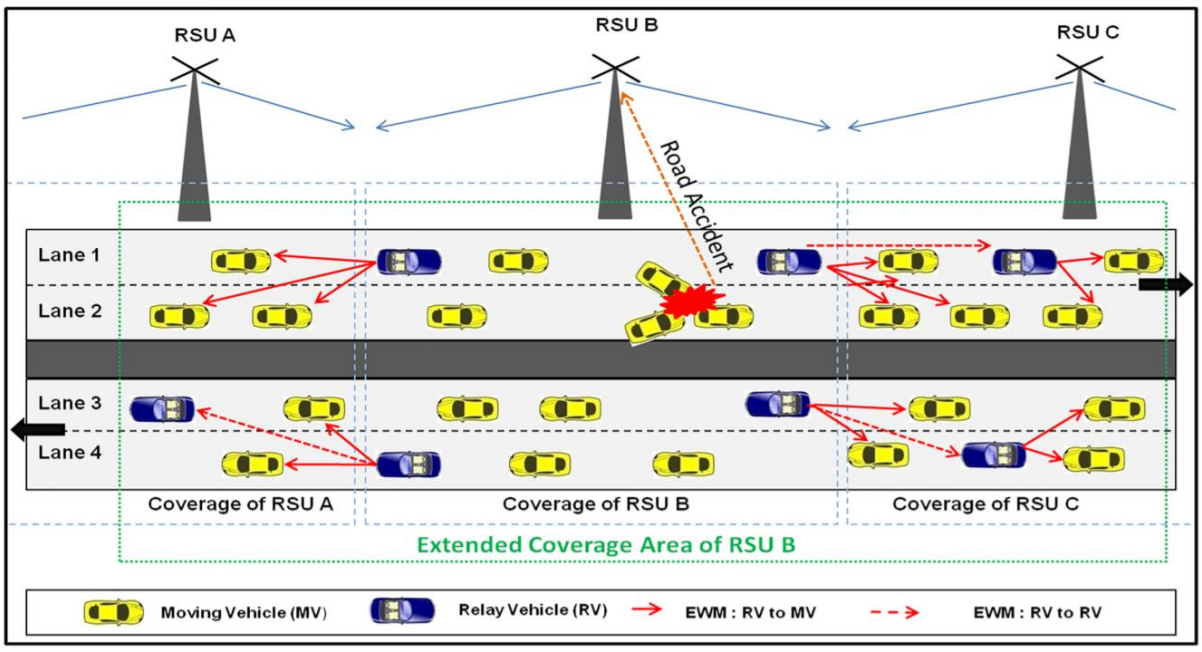
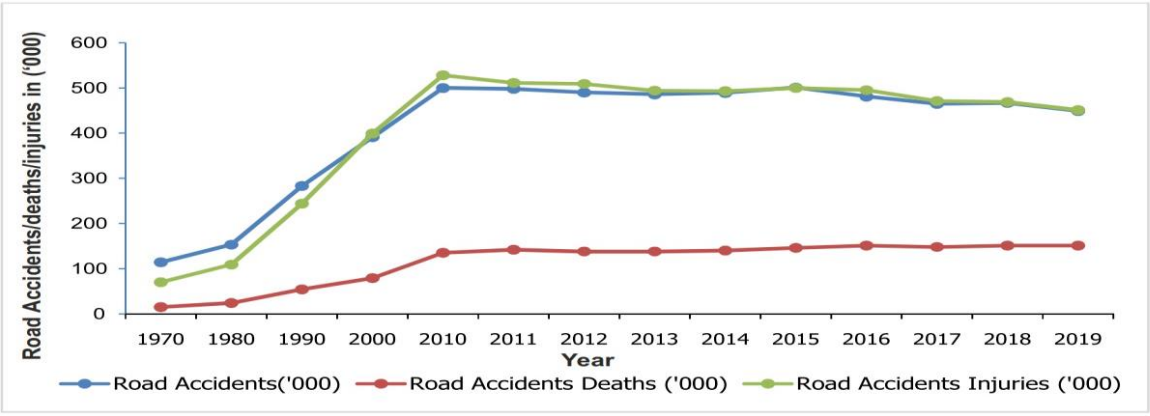



Fig. Organization of VBN structure




**Trends of Road Accidents, Deaths and Injuries**

Fig. The graph above represents the data of road accidents, deaths caused due to road accidents and injuries sustained in India from 1970- 2019.

## 5. Proposed Solution

The RAP scheme offers the following contributions:

First, based on successful prediction of emergency situations in advance by using protocols like ESPM, the RSU generates an Emergency Warning Message (EWM).

Second, the structure of EWM consists of information such as (i) EWM ID (ii) source (RSU) ID (iii) vehicle ID (iv) position of the emergency causing vehicle (v) speed of the vehicle and (vi) travel direction of the vehicle.

Finally, the EWM is instantly disseminated to all the vehicles which hold the high Risk Factor (RF) and travel in the High Risk Zone (HRZ).

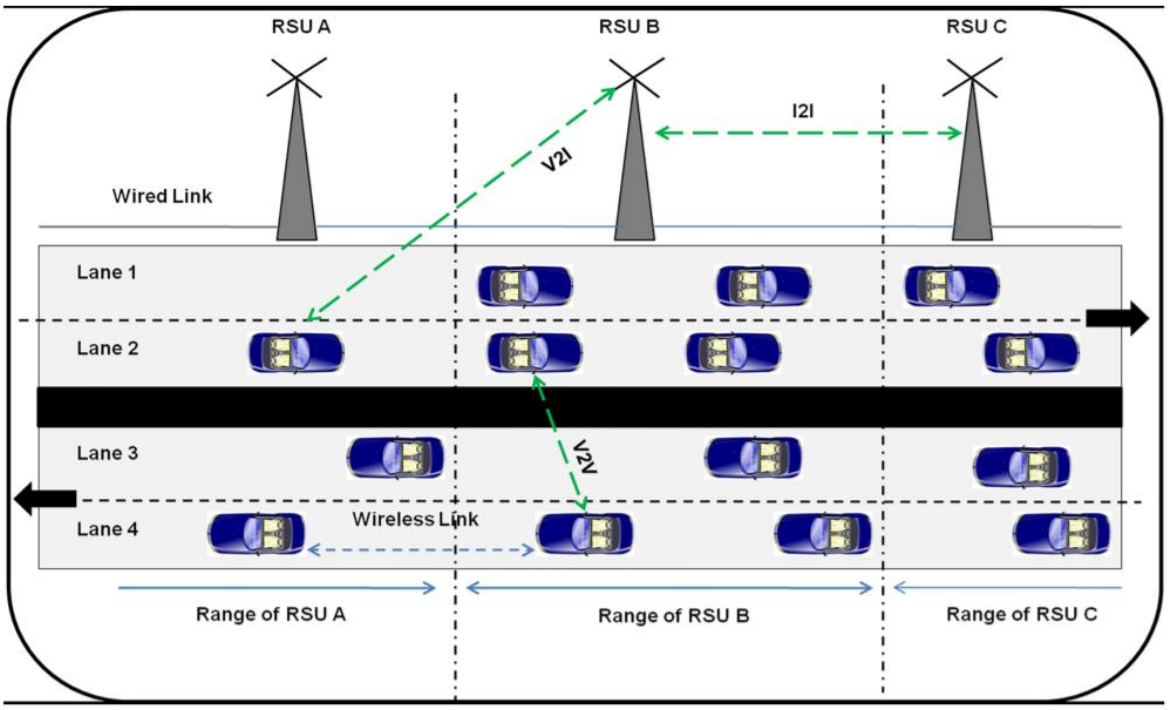



Fig. Architecture

These vehicles travel both within and outside the RSU's coverage (extending the coverage area of RSU by using the VBN structure). Suppose if the vehicles receive the EWM, they make necessary decisions such as slowing down, performing lane change, de-touring and choosing alternate routes. The system and driver of the vehicle should cooperate with short reaction time for successful prevention of accidents. The role of the driver in road accident prevention is vital. The reaction time of the driver for acceleration or deceleration adjustment is strongly

influenced by perturbations and traffic interruption probability. It is learned from literature that the dynamism in the traffic flow has an impact on the driver behaviour. Further, the traffic interruption probability might make the traffic flow stable. The fuel economy can be optimized via applications like Fuel Economy Optimization System (FEOS), which assists the driver to cut the fuel requirement during accelerations and decelerations.

Whenever the road side unit predicts an abnormality in the highway road segment, broadcasting of EWM takes place in two steps. First, the road side unit broadcasts the EWM to all the vehicles in the area of coverage and to the near-by road side units. Second, the near-by roadside units propagate EWM to the vehicles in their respective area of coverage. It is well known that the EWM should be delivered on time for prevention of road accidents. Let the second step be considered, where end-to-end delay would be poorer because the EWM has to travel a long distance to reach the destination as shown below.

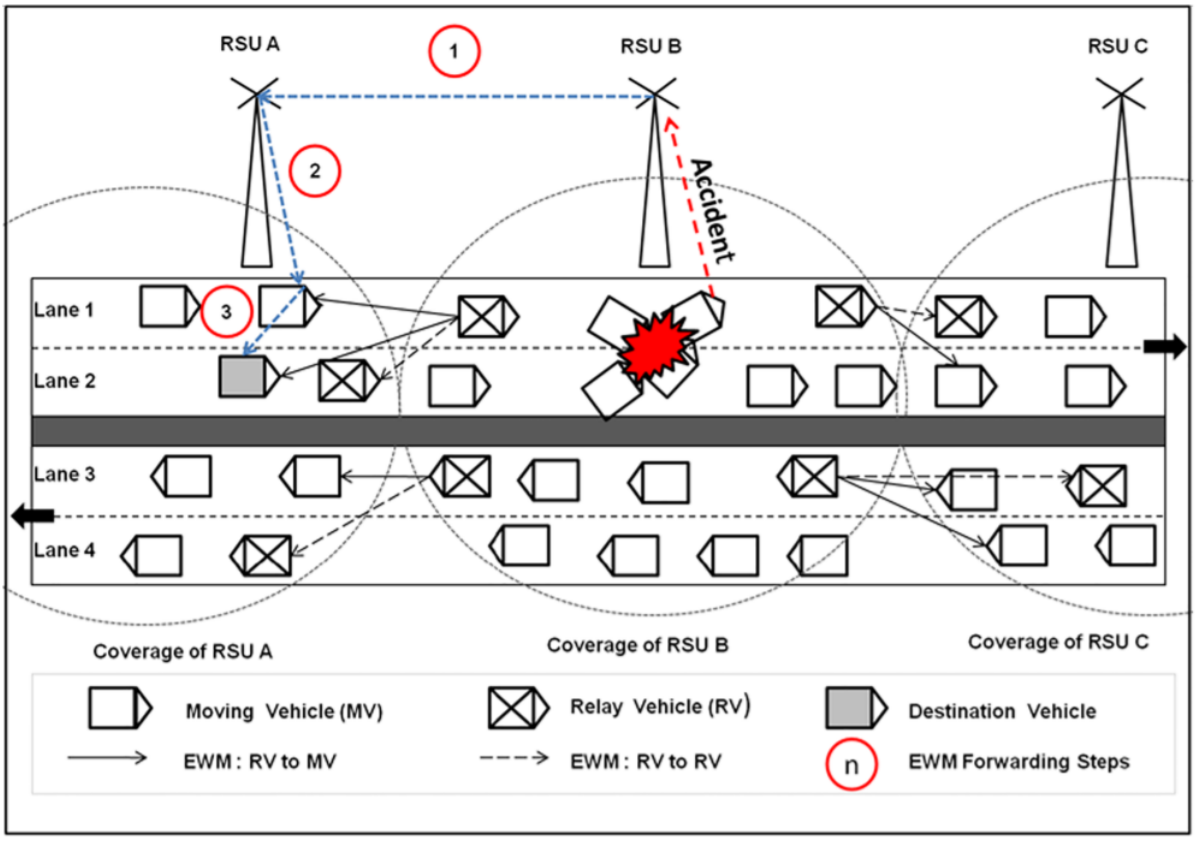



Fig. RAP Scheme 1: EWM Dissemination without VBN Structure

Due to this problem, the VBN structure is introduced, where the EMW has to travel a lesser distance as shown below.

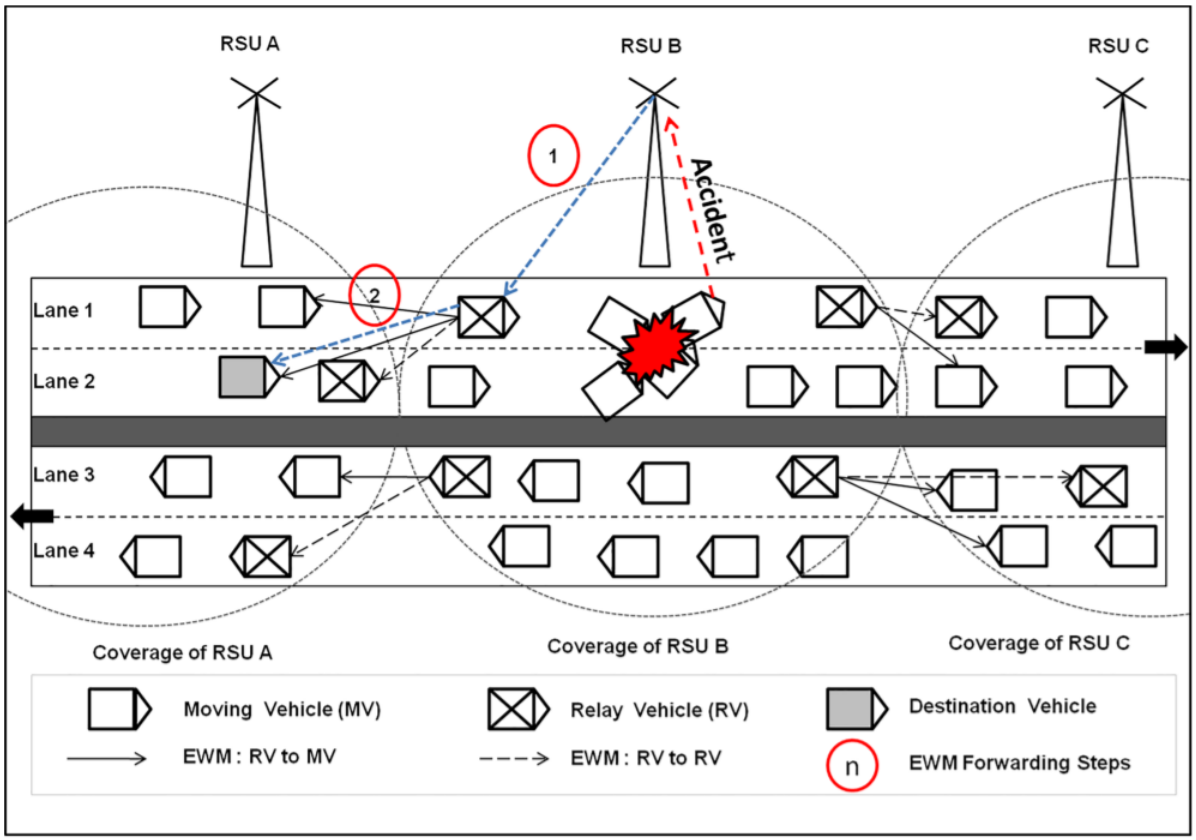



Fig. RAP Scheme 2: EWM Dissemination with VBN Structure

The VBN structure would be complete only if certain participating vehicles are selected as the Relay Nodes (RN). These relay nodes are used to forward the EWM to the vehicles within roadside unit's coverage and the relay nodes outside the RSU's coverage by using multi-hop communication. Any violation by the RNs in the forwarding process might make the entire system fail. Hence, the relay node selection algorithm should be very effective.

In RAP scheme, two types of relay nodes are selected (i) the relay nodes that belongs to Source road side unit or Home RSU called Home RN (H-RN) and (ii) the relay nodes that belong to the near-by RSUs or Foreign-RSUs called Foreign RN (F-RN). In existing algorithms, the relay nodes are selected based on speed and distance between the vehicle and the RSU. But in the RAP scheme, the relay nodes are selected based on criteria such as speed and position of the vehicle with respect to the road side unit's coverage boundary.

First criterion is chosen because a slow moving vehicle will reside in the road side unit's coverage for a longer time than a fast moving vehicle. That is, the lifetime of a slow moving vehicle in the coverage area is more than other vehicles. Second criterion has been chosen because if the distance between H-RN and F-RN is lesser, then an effective EWM dissemination can be achieved. Once the VBN timer (100 ms) expires, this module retrieves speed and position of the vehicles from the RSU-VBN register. As per the Figure below, if a

vehicle's speed is less than 60 km/h and the position of the vehicle lies either within 0 and 20 meters or 480 and 500 meters then that vehicle will be selected as H-RN.

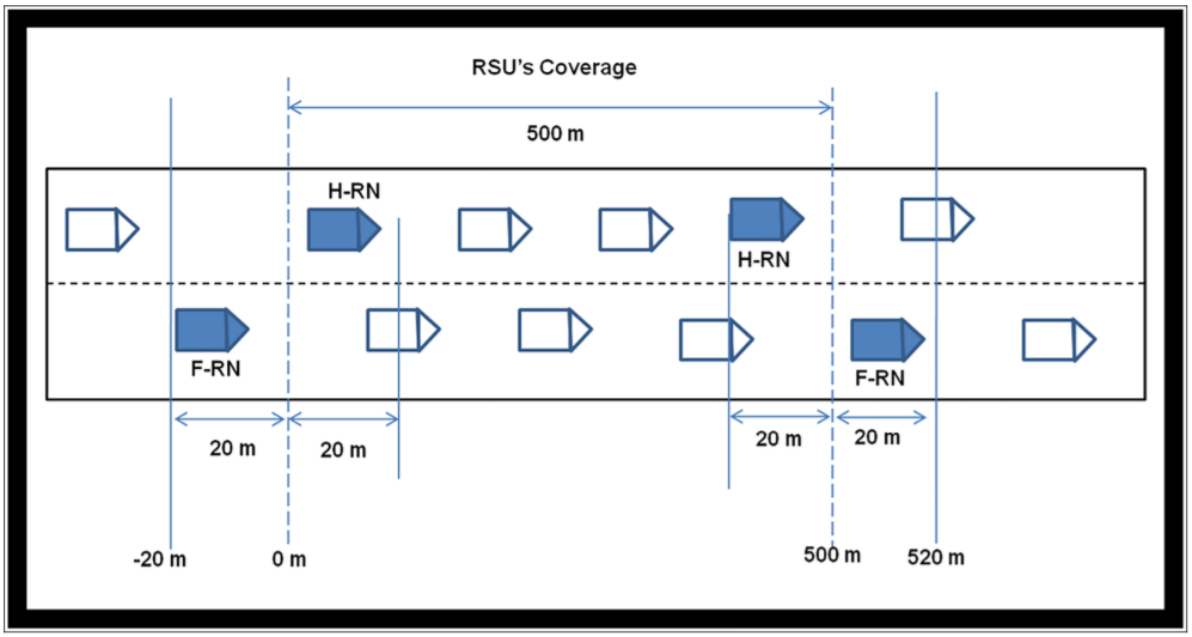



Fig. RN selection in VBN structure

In similar way, if the speed of the vehicle is lesser than 60 km/h and the position of the vehicle lies either within -20 and 0 or 500 and 520 meters, then the vehicle is selected as F-RN as shown in Table 6.The vehicles 1020 and 5007 are selected as H-RNs and the vehicles 8496 and 2129 are selected as F-RN, because these vehicles satisfy the criterion for RN selection.

The EWM should be immediately delivered to the vehicles in the high risk zone as these vehicles have to instantly react either by slowing down or performing lane change. Next to the high risk zone, the EWM delivery should be made to the vehicles in medium risk zone and then to the vehicles in low risk zone as these vehicles have to make a decision either to detour or take alternate routes to travel.

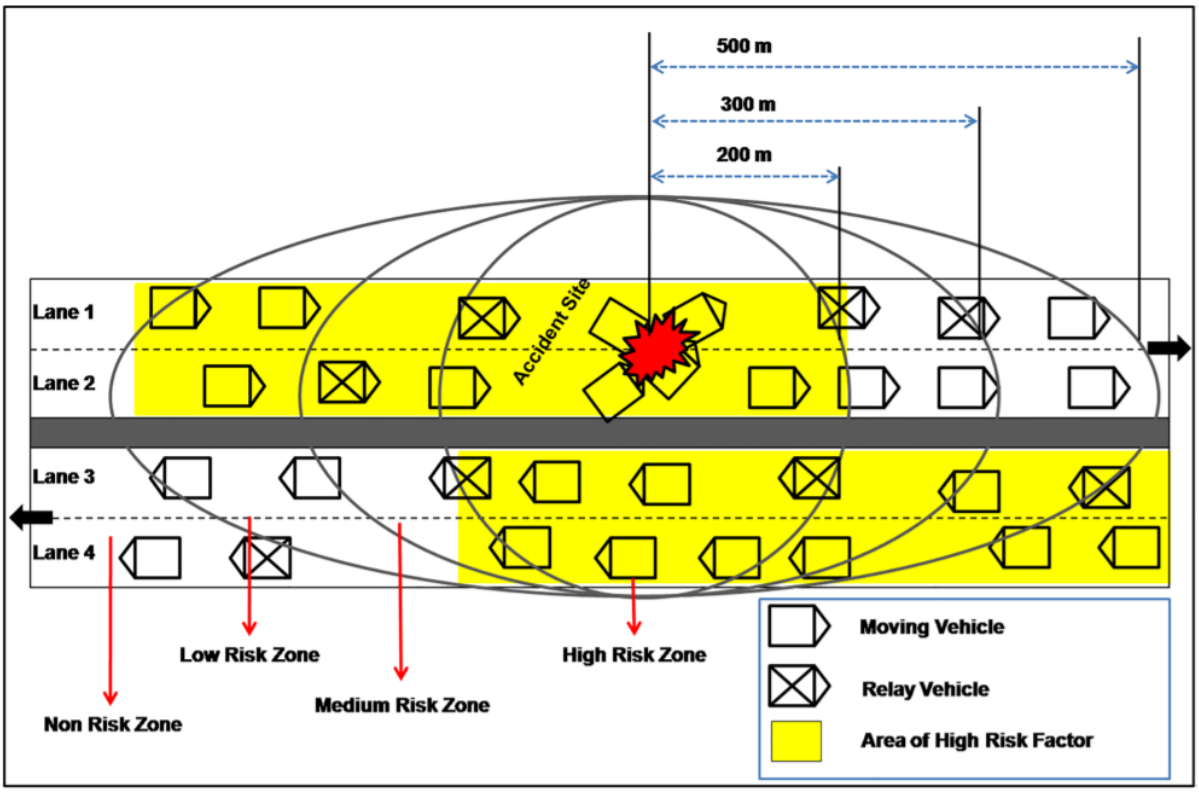



Fig. Representation of Risk Zones and Risk Factor

Pertaining to the given scenario, in this work, a Road Accident Prevention (RAP) scheme for instant EWM dissemination to the vehicles is proposed in order to prevent them from highway road traffic accidents, thereby reducing the death and injury rates in Indian four lane highways.

## Q2. Elderly people tend to slip and fall inside the washroom and break the hip bone leading to very painful death. Design a system to protect them from such falls.

# 1. Introduction

Statistics have shown that falls are the leading cause of accidental deaths among people over the age of 75 and 55% of all falls take place in homes with most falls occurring in the washroom. Over a third of the elderly are admitted to the hospital due to falls that take place in washrooms. Of all the elderly that are hospitalized due to falls, 50 percent of them fail to survive a year. Many elderly increase their degree of injury due to fainting in the washroom and not being able to get medical help in time. During the fall, patients may suffer from shock or unconsciousness and it is important for immediate medical aid to reduce the aftereffect.

A very high morbidity and mortality due to fractures as a result of fall is reported world over. Most of the falls are during toileting or bathing, which are quite often cardiovascular syndrome (CVS) and myocardial infarction (MI) leads to an emergency medical condition, and are common in vulnerable groups such as elderly or handicapped or pregnant mothers. Most people who find the bathroom a quiet retreat, never for a second consider this room as a dangerous place. A recent study shows that one of the single biggest gaps in most of the home safety plans is the bathroom; it is surrounded by water, slippery tiles and hard ceramic surfaces. The conditions of the toilet and bathroom need to be assessed with a systematic design for the comfortable utility as well as to minimize the accidental falls and other mishaps.

The main purpose of this research is to raise the awareness level among the general population, health care professionals and engineers who design the bathroom for the elderly people. The study demonstrates the efficacy of new architectural design approaches with pragmatic studies in reducing the accidents and enhancing the comforts to the elderly people in India while bathing.

## 2. Literature survey

| S.No. | Paper Title | Name of the Conference/ Journal, Year | Methodology Used | Disadvantages |
|---|---|---|---|---|
| **1.** | Design and Pragmatic studies of bathroom for Elderly people in India | MS Nagananda, A Sengupta, J Santhosh, S Anand - 2012 - wseas.us | It has grab bars around the bathroom, exit fan, alarm switch, shower, tap, bidirectional accessible door, permanent sitting facility, mat furnished floor for anti-slippery, ventilation provision, and podium for the mobile chair (toileting cum bathing). Toilet cum bathing facility is designed with a simple easy mobile chair with push buttons. | • Expensive in case of renovation/new construction.<br>• Grab bars and podiums for mobile chairs in the bathroom could be an obstacle for other members of the family. |
| **2.** | The accurate falling detection system for the elderly | JND Ong, H Zhang, VYA Lee, C Phua, K Sim - APEC Youth Scientist, 2012 - amgs.or.kr | There are two rounds of simulation, one that ensures that the forms of the rules are correct and another to test out the actual scenario. The simulations to test out the actual scenario were done in a handicapped toilet. There were two parts to this simulation. Firstly, different scenarios were tested systematically, with four possible events, mainly, bending to use the tap, sitting on the toilet seat, falling and nurse intervention. Then, simulations based on free scenarios were tested to ensure that the system would work regardless of the actions in the washroom. | Since the Ultrasound Sensor measures the linear distance between the Sensor and the person, the data would be skewed if the person was in a corner of the room as the distance would be greater. For example, though the height of the object from the ground is the same, the perceived distance of the person from the Ultrasound sensor is greater in the corner, thus skewing the results. This could result in the ultrasound sensor sending out wrong signals to the system, as the state of the sensor could be wrong. |

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| **3.** | Bath-related deaths in Kagoshima, the southwest part of Japan | Hayashi, T., Ago, K., Ago, M., & Ogata, M. (2010). | The records of sudden death in the bathroom were carefully gathered and assessed. In each case, the patients' details, including gender, age, month in which the episode occurred, location where the episode occurred, time of day when the episode occurred, a history of alcohol use, a past history of illness and the cause of death, were reviewed. | As mentioned in the paper, a considerable amount of bath related deaths occurred after alcohol consumption and the data for people who consumed alcohol is not seperated from others and bath-related death should be considered common in the daily life of the elderly without alcohol drinking. |
| **4.** | Medical Costs of Fatal and Nonfatal Falls in Older Adults | Florence CS, Bergen G, Atherly A, Burns E, Stevens J, Drake C. 2018 | The incidence and costs of fatal and nonfatal falls in US were calculated separately because no single data source measured fatal and nonfatal falls. | The paper focuses more on the economical impact of the incidents on the government rather than the individuals. More focus on the affordability of the costs and the economic impact on the elderly could've been put as looking at the problem from only a macro scale would be insufficient as the impact on individuals also matters. |
| **5.** | Fall-related emergency department visits and hospitalizations among community-dwelling older adults: examination of health problems and injury characteristics | Choi, N.G., Choi, B.Y., DiNitto, D.M. 2019 | using multinomial logistic regression analysis, the paper examined associations of healthcare utilization (ED visit only and hospitalization vs. no ED visit/hospitalization) with chronic illnesses, other health problems, and injury characteristics, controlling for socioeconomic factors. | In addition to treating underlying causes of falls, access to effective fall prevention programs that target risk factors specific to serious injuries requiring these costly forms of care are needed. |

## 3. Methodology

**User demands:**

• Bathrooms must be free from slippery, sharp edges, and obstacles.
• Good lighting facility (natural or artificial).
• Good ventilation and good slope to eliminate water logging.
• Impact less floor will reduce the probable injury from the fall or slippery

**Necessities to design a bathroom for elderly:**

Bathroom – toilet design should be as per specific requirements of elderly persons, it could be spacious with good ventilation, non slippery floors.

• Grip support or grab bars to the entire bathing toileting room.
• Permanent sitting facility for relaxing purposes.
• Bidirectional door access (emergency situations)
• Wind movement study for proper ventilation
• Shelf to keep hand towels, napkins, and other accessories.
• Hand shower to avoid excessive movements.
• Night lamps to ease night walking to the bathroom.
• Bigger size electrical switches at a comfortable height.
• Exit and ordinary fans must be provided to maintain temperature and to dry the bathroom.
• Alarm switch with falling sensor and telephone with single digit emergency dialling.
• Bathroom should be near an elderly room, preferably an attached bathroom.
• Good slopes to eliminate water logging.

**Process while bathing:**

Bathing without assistance and with assistance is analyzed for the design purpose. Approach the bathroom with the following actions (Walking with a stick, removing cloths, cleaning the body with water, soap (or paper soap) under shower and drying the body after bath without assistance) and with assistance, to wash, clean, dress and get ready is shown in figure 3. Mapping activity in the bathroom like collecting required accessories, undressing, bathing, urinating, washing, and dressing is shown in the flowchart.

**Design:**

Elderly specific bathroom layout is shown in figure 1. It has grab bars around the bathroom, exit fan, alarm switch, shower, tap, bidirectional accessible door, permanent sitting facility, mat furnished floor for anti-slippery, ventilation provision, and podium for the mobile chair (toileting cum bathing). Toilet cum bathing facility is designed with a simple easy mobile chair with push buttons as shown in figure 2. Mobile chair has a stepper motor for mobility and control, the motor is completely covered and isolated from water for safety purposes (to eliminate electric shock). Mobile chairs with a bathing-toilet facility can be accommodated in

the bathroom or separately housed for toileting purposes. Toileting and bathing will be very easy using push buttons. Design prototypes are shown in figure 1 & 2.

**Advantages:**

• Elderly specific design, suitable for all members of the family, safe and user friendly design.
• For severely disabled persons, the mobile chair with a bathing cum toileting chair could be used.
• Bathroom has a provision to accommodate a mobile chair with a bathing-toilet facility.

**Limitations:**

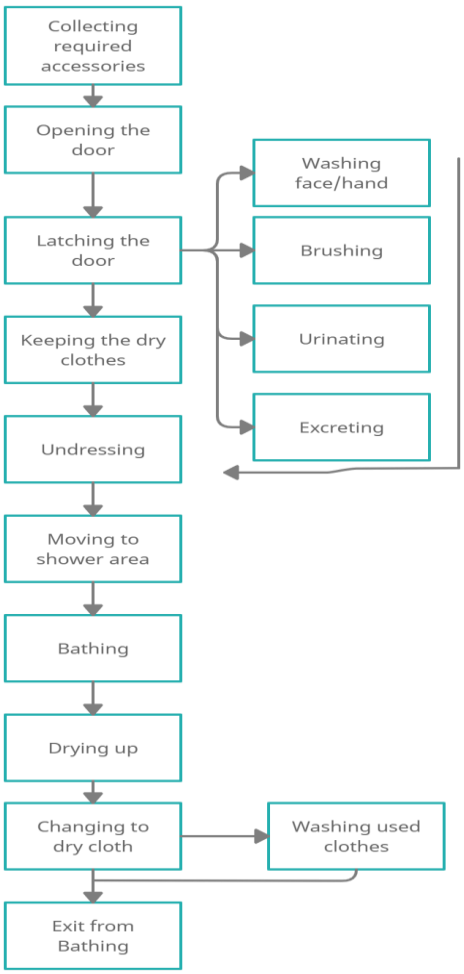
• Expensive in case of renovation/new construction.
• Grab bars and podiums for mobile chairs in the bathroom could be an obstacle for other members of the family.

**Applications:**

• Suitable for all family members.

## 4. Diagrammatic Representation

Flowchart of works:



Own design

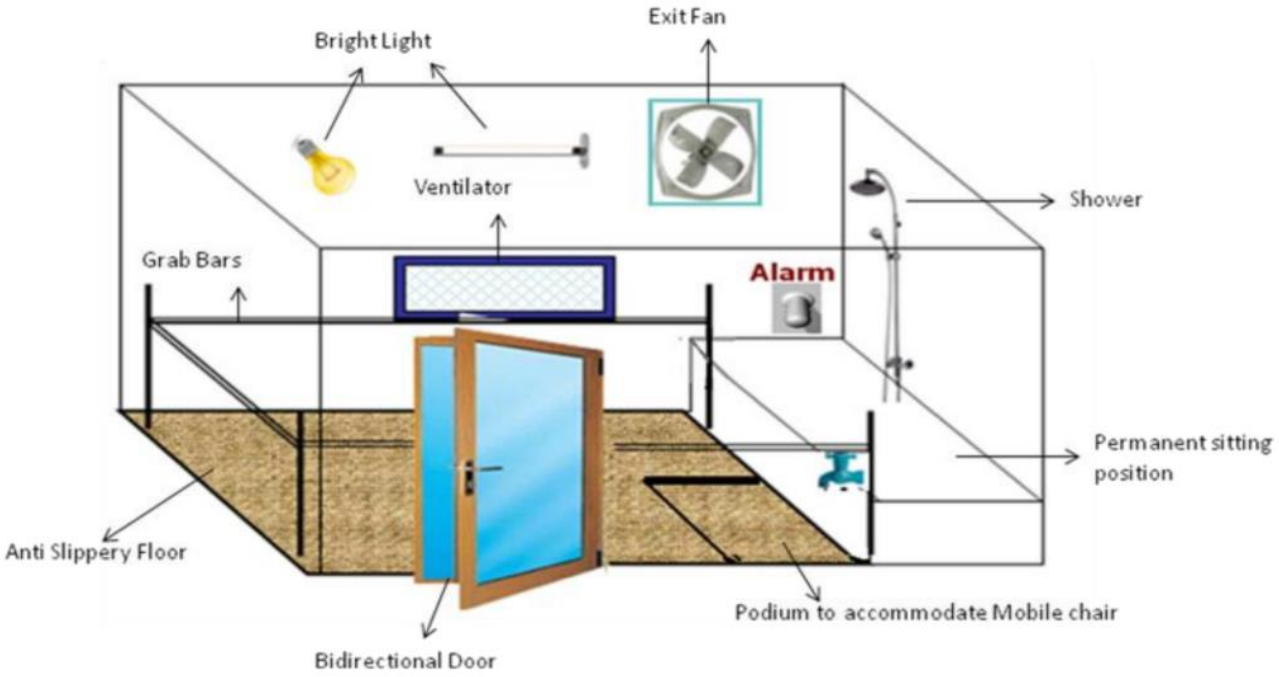



**Figure 1- Bathroom layout Design**

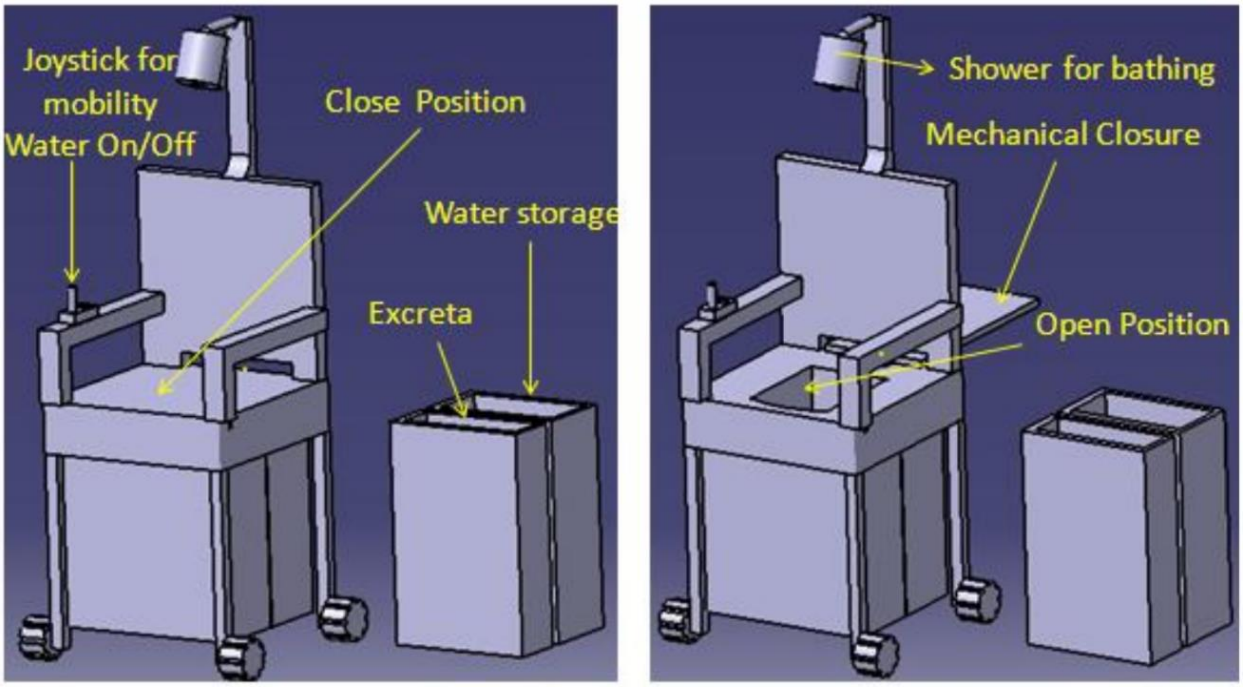



**Figure 2- Toileting and bathing facility on mobile chair**

**Figure 3- Process while bathing without and with assistance**

## 5. Proposed solution

**Lifestyle changes**

- Keep physically active. Whatever your age, aim to do at least 30 minutes of activity, 5 times a week that will help make you stronger and improve your balance. Suitable activities include tai chi, dancing and group exercise programs.
- Eat healthily. Enjoy a wide variety of food and drinks, particularly during hot weather. Food supplements may help if you are very thin.
- Stand up slowly after you have been lying down or sitting to prevent posture-related dizziness.

**Changes around the house**

The risk of falling can be reduced by making positive changes to 3 types of potential hazard found in your home: lighting, slipping, and tripping.

- **Lighting**

Good lighting around the house is important. Turn lights on when you walk around. Leave hallway lights on at night. You can reduce glare inside your house by using net curtains or blinds on your windows. These changes make it easy for your eyes to see where you are going and reduce the chances of a fall.

- **Slipping**

Changing what you wear around the home and fixing dangerous surfaces can reduce the risk of slips occurring. Use non-slip mats in wet zones, such as the shower and bathroom. For larger rooms, it may be worth making the whole floor with non-slip material. Install hand rails or a seat in the shower or bath. Place non-skid tape on the edges of steps and stairs to make it easier to see. Remove moss, slime or fallen leaves from outdoor paths. Wearing properly fitted shoes that fit firmly to the foot can also help prevent slips.

- **Tripping**

Even small things can be trip hazards. Keep any walkways clear of clutter, and tape down any electrical cords along skirting boards. Mark any small changes in floor level with contrasting colour so they're clearly seen. Install a "draught excluder" on the bottom of doors instead of loose material that can be tripped over. Get rid of old mats and torn or stretched carpet.

## Changes in the Bathroom

- **Install Grab Bars**

Grab bars are an indispensable tool for elder care bathroom safety.
They perform two essential functions. First, they give your loved one something to grip when moving in and out of the tub or getting on and off the toilet.
Second, in the case of a fall, grab bars will be there for your loved one to grab before falling.

- **Install Non-Slip Surfaces**

Many falls are caused by slippery surfaces. To prevent slips, it is advised that you install non-slip surfaces on the floor of your loved one's tub or shower.
Non-slip decals should also be applied to bathroom tile, which can be just as dangerous as the tub when wet.Remove scatter rugs, which are easy to slip on or trip over.

- **Improve Accessibility**

Making sure that commonly used items are within easy reach is essential for areas like bathrooms where the risk of slipping or falling is heightened.
This is especially important in the shower/bathtub. Make sure that soap, shampoo, conditioner, towels, and any other bathing items are within easy reach.

- **Remove Obstacles**

Bathroom safety can be improved by removing items that are easily tripped over.One of the biggest risks for the elderly is tripping over the side of their bathtub. Installing a walk-in shower or walk-in bathtub can prevent this from occurring.

- **Reduce Risk of Over-Exertion**

Overexertion is the No. 2 most common cause of injuries in the bathroom, behind falls, according to the CDC study.
Consider installing a secure bathing seat and a raised seat for your loved one's toilet, to help your loved one avoid over-exerting him or herself.

- **Improve Visibility**

For many elderly people, frequent urination – especially at night – is a common complaint. By installing night lights that illuminate the walkway from the bedroom to the bathroom, you reduce the chance of a fall or injury.

- **Prevent Hot Water Burns**

Elderly people have thinner, more delicate skin and can take longer to notice hot temperatures.
Because of this, they are often at increased risk of burns caused by hot water. Make sure your loved one's bathroom taps are labelled and keep hot water temperatures to a maximum of 120 F.

Finally, elder care bathroom safety can always be improved by having someone around to look after your loved one.

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