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Low Water Crossings: The Hidden Danger

Gireedhar More¹, Pratik Patil², Harshwardhan Mane³, Sourabh Sawant⁴, Anushri Gadavi⁵, Pranali Bobade⁶,
Sapana Jagdev⁷, Sonal Methé⁸

^{1,2,3,4} Department of Mechanical Engineering, Shivaji University, Kolhapur

^{5,6,7} Department of Electronics & Tel. Engineering, Shivaji University, Kolhapur

⁸ Department of Information Technology, Shivaji University, Kolhapur

Abstract— This invention relates to the field of electronics engineering and mechanical engineering more particularly to reduce accidents along with preventing operators from driving a motorized vehicle in watercourses overflow conditions. Nearly 1/2 of all flood deaths rise in vehicles. Most of those deaths take area while humans power into flooded dual carriageway dips or low drainage areas. A low-water crossing is wherein a road, without a bridge, dips through a usually dry creek mattress or drainage area. Motorists who try to pass those flooded low-water crossings are setting themselves, their vehicles, and any other occupants of their vehicles at deadly risk. In a preferred embodiment, once the system determines the speed of the water flow & depth of the water flow then it starts to give signals in the form of red for danger and green for neutral conditions. On the basis of this driver, a person can think about crossing the flooded bridge.

Keywords— Bridge, River, Drowning, Overflow, Rainfall, Flood Problems, India.

I. INTRODUCTION

India is one of the maximum flood-susceptible international locations withinside the international after Bangladesh and those are pretty not unusual places for the duration of the country. However, their traits range from vicinity to vicinity. Very little known about drowning deaths that occur as the result of motor vehicle traffic accidents. Heavy rainfall causes many watercourses to overflow. In these circumstances, crossing by car or even on a road, can be extremely dangerous; however, dozens of drivers are swept away every year in their vehicles. The main cause of these accidents was the driver's behaviour due to: underestimating risk, overconfidence, overvaluation of Their using skills, an extra of belief withinside the authorities, lack of awareness about car drag and buoyancy risks, and social pressure. To reduce these risks, it is necessary to increase adoption and protection measures on roads, but above all, a change in drivers behaviour to stop them trying to cross-flooded rivers/bridges. According to Fluid Dynamics water weighs about 62.4 pounds per cubic foot and typically flows downstream at 6 to 12 miles an hour. When an automobile stalls withinside the water, the water's momentum is transferred to the car. For every foot the water rises, 500 kilos of lateral pressure are carried out to the car. For every foot the water rises up the facet of the automobile, the automobile displaces 1,500 kilos of water. In effect, the car weighs 1,500 pounds a whole lot less for every foot the Water rises! Therefore, maximum motors will go with the flow in only ft of water! More than 1/2 of of flood-associated drowning arise when a person drives into unsafe water, consistent with the Centres for Disease Control and Prevention and the National Weather Service. Flood-associated deaths range appreciably from yr to yr, primarily based totally on climate conditions. For the past decade, the average has been a hundred deaths consistent with yr, primarily based totally on NWS data.

More than 1/2 of all low-water crossing vehicular associated deaths arise at night. Under situations of low-visibility the vulnerability of the driving force and passengers to the hidden hazard is significantly magnified. High volumes of shifting water play havoc on bridges, street beds, and different structures. What can also additionally seem as a regular street, can also additionally in fact, be a loss of life trap. Therefore, all posting warnings and barriers adhered to. When the facet of the frame of an automobile makes contact with the water the pressure will increase swiftly however the water now additionally acts on the bottom of the automobile as properly and begins off evolving to boost it. It is now able to float like a ship. The weight of the automobile will now no longer be capable of keeping it on the road. Every cubic meter of area in an automobile can raise one ton. Flowing water applies pressure to contact areas. The higher the speed the higher the pressure. With a wheel 1/2 of below water is the region 0. four sq. m and the pressure 0. four ton in line with the wheel. For the 4 wheels it will become one and a 1/2 of lots and for 2m of water it will become 2 ton in line with sq. m. Most drowning deaths appear inside the simplest 3m of a secure point. To avoid all the above conditions we have created a system which consists of assembly of various sensors and hardwares to measure flow of the water of the flooded bridge and depth of the water of the flooded bridge to avoid vehicles from being swept away and causing deaths.

II. OBJECTIVES

Cars become buoyant on the toes of water or less. People who have previously driven successfully through a Flooded low-water crossing frequently do now no longer apprehend that an growth of an inch or so withinside the water degree can be all it takes to

tip the balance of buoyancy against them! Few people, which includes Public Safety and Rescue personnel, recognize the strength of flowing water. Fewer humans realise how rapid water can upward thrust in a small circulation to flood a low-water crossing area. More than half Of all low-water crossing vehicular associated deaths arise at night. Under conditions of low-visibility the vulnerability of the driving force and passengers to the hidden risk is substantially magnified. Extensive volumes of active water play torrent on bridges, roadbeds, and other structures. What can also additionally seem as a regular road, can also additionally in fact, be a loss of life trap. Motorists who try to move those flooded low-water crossings are setting themselves, their motors, and some other occupants in their motors at lethal risk. Due to which India caused 948 flash flood deaths in 2019 & an average of 100 deaths occurred per year due to vehicles swept away while crossing the flooded bridge. To resolve the above stated problem a system is designed to identify water flow speed of the flooded water and the vehicle eligibility to cross the bridge so as to restrict the vehicle from crossing the flooded bridge. This will reduce the possibility of vehicles being swept away while crossing flooded bridges thereby saving lives of the drivers and the people on/in the vehicle. Various sensor assemblies are connected and by analysing multiple factors and calculating the speed of the water flow the vehicle will be permitted to cross the bridge.

III.LITERATURE SURVEY

Rory Austin, [1], Very little is known about drowning deaths that occur as the result of motor vehicle traffic accidents. The two research questions addressed in this paper are how frequently do drowning deaths as a result of motor vehicle traffic accidents occur and what are the circumstances surrounding these deaths. Overall 63 percent of the passenger vehicle drowning fatalities involved a rollover, and 12 percent involved a collision with another motor vehicle. The most common passenger vehicle crash scenario was a single-vehicle rollover accounting for 59 percent of the fatalities. In cases with known restraint use, the victim was not using any form of restraint system 52 percent of the time. Two types of motor vehicle related drowning deaths are not included in FARS based upon the American National Standards Institute's (ANSI) definition of a motor vehicle traffic accident. The first type is a drowning that occurs as the result of a nontraffic accident, which occurs off of public roads. While NHTSA collects information about nontraffic crashes, it does not have the multiple cause of death information to enable a similar analysis. The second type is a drowning as the result of a cataclysm, such as flooding, that is not a motor vehicle accident fatality per ANSI definitions. Including nontraffic and cataclysm cases would lead to a larger number of motor vehicle related drowning fatalities.

Pune, From ndtv.com | July 23, 2021 3:41 pm IST [2]: Eleven people on board a bus had a narrow escape as they were rescued just before the vehicles got washed away into a river in Kolhapur district of Maharashtra early on Friday, police said. The incident occurred around 2:30 am at Pangire village in Bhudargad tehsil when the bus driver, despite being asked by the police and the PWD personnel not to go ahead, drove the vehicle over a bridge even as the water of the Chikotra river was flowing with strong force, due to which the bus fell off the bridge and got stuck in water before being swept away by the strong currents. Idduki, TMN|Oct 17, 2021, 04:50 IST [3]: Two people were drowned when a car was swept away while trying to cross a flooded bridge near Kanjar in Thodupuzha in Idduki. The car was washed away around 2pm at Moonnunkavayal Bridge. The bodies of Koothattukulam residents Nikhil Unnikrishnan (29), and Nima K Vijayan (31) were recovered within a couple of hours of the incident. Police said they had come from Vagamon and that the mishap occurred while they were on their way to Moonnunkavayal. Local residents said they warned them not to cross the bridge but they drove ahead and the car got stuck. Before they could escape, a flash flood washed them away.

Anantpur, India TV News Desk| New Delhi | July 30, 2020 16:55 IST [4]: Anantpur District in Karnataka. As the car tries to cross what appears to be a small bridge on the stream, the water drags it off the bridge and washes it away with travellers inside. It's always dangerous to drive a vehicle through such a wnantpuater body, and especially when it is flooded. What seems like an easy crossing may often turn into a life and death situation. The men in this car were lucky the stream was shallow. It may not be the case.

Yavatmal (Maharashtra), IANS – updated: September 28th, 2021, 11:44 IST [5]: Yavatmal (Maharashtra): A State Transport inter-district bus with at least eight passengers on board was washed away as it was crossing a bridge on a flooded river in Umerkhed, here Tuesday morning. Apparently ignoring warnings by locals, the Maharashtra State Road Transport Corporation (MSRTC) Nanded-Nagpur bus drove ahead in the flood waters which submerged the bridge. Barely had it gone a few meters, the bus got trapped in the powerful water currents, the river lost control and the vehicle with the passengers toppled into the river. Almost sunk to the roof, it was pulled ahead several meters by angry river water before it got stuck in a fallen tree trunk. At least four of the passengers managed to clamber into the roof of the bus, bobbing dangerously in the swirling river and three were rescued by the villagers.

IV. RESEARCH METHODOLOGY

Flash floods are the maximum risky sort of floods, due to the fact they integrate the adverse strength of a flood with wonderful speed. Flash floods arise while heavy rainfall exceeds the capacity of the floor to soak up it, or while sufficient water accumulates for streams to overtop their banks, inflicting a speedy riot of water in an instant. They can come off within minutes of the enabling rainfall, and curb the time available to appraise and preserve the public. Nearly 1/2 of all flood deaths rise in vehicles. Most of those deaths take place whilst human beings power into flooded dual carriageway dips or low drainage areas. A low-water crossing is in which a road, without a bridge, dips throughout a typically dry creek mattress or drainage area. Motorists who try to move those flooded low-water crossings are placing themselves, their cars, and every other occupant in their cars at lethal risk. Each year, greater deaths arise because of flooding than from every other thunderstorm-associated hazard. The Centers for Disease Control and Prevention document that greater than 1/2 of all flood-associated drownings arise while a car is pushed into dangerous floodwater. The subsequent maximum percent of flood-associated deaths is because of strolling into or close to floodwaters. People underestimate the force and power of water. Many of the deaths arise in motors as they're swept downstream. Drowning, many are preventable, but too many people continue to drive around the barriers that warn that a road is flooded. A mere 6 inches of fast-shifting flood water can knock over an adult. It takes simply 12 inches of dashing water to hold away a small car, even as 2 ft of dashing water can bring away maximum vehicles. It is by no means secure to force or stroll into flood waters. We have placed a water depth measuring sensor to know the depth of the flooded bridge water & water flow speed measuring sensor to know the flow speed of the flooded bridge water which is flowing over the bridge. Once we have got the depth and flow speed of the water we have given that input to the signal controller which is present at both sides of the entrance of the bridge. Based on this, if the water is flowing with a flow speed of 1.3 km/hrs. with water, depth is 10-15 cm only then the red light will be illuminated for two-wheelers & pedestrians. And for the other vehicles like cars, buses, or trucks green light will be illuminated. On the other hand, if the water is flowing with a water flow speed of less than 1.3 km/hrs. with a water depth of 10-15 cm then the green light will be illuminated for all of these three categories of the vehicles. Similarly for a water flow speed of 3.2 km/hrs. With a water depth of 30-40 cm then the red light will be illuminated for both four-wheelers and two-wheelers. On the other hand, if the water flow speed is less than 3.2 km/hrs. & water depth is less than 30-40 cm then the green light will be illuminated for all three-wheelers, four-wheelers, buses & trucks and the red light will be illuminated for two-wheelers only. In the end, if the water flow speed is 8-16 km/hrs. with a water depth of 40-60 cm, the red light will be illuminated for all types of vehicles & pedestrians. On the other hand, the water flow speed is less than 8-16 km/hrs. & water depth is less than 40-60 cm then the green light will be illuminated for buses, trucks, or containers and the red light will be illuminated for two-wheelers, three-wheelers & four-wheelers. Based on this, we can check the desirability & undesirability of crossing flooded bridges. If the flow is not desirable for a particular type of vehicle that will be indicated by red light, with help of this driver, the person can decide whether he should cross that flooded bridge or not. This will be helpful to avoid deaths related to low water crossings.

V. ANALYSIS OF ACCIDENTS

Statistics in India is one of the maximum flood-inclined international locations within the international after Bangladesh and those are pretty not unusual places in the country. However, their traits vary from place to place. Poor street signs, loss of warnings, potholes, and dug-up roads are essential reasons for injuries for the duration of the monsoon period. The age-old drainage systems in Their using skills, an extra of what is accepted as true within the authorities, lack of expertise approximately automobile drag and buoyancy risks, and social pressure. To reduce This is leading to overflow of drainage on to the roads. The rains coupled with the drainage overflow, the first-rate and inadequate volume of roads, and encroachment of footpaths through avenue carriers are ensuing in potholes, visitors stalling, and accidents. Statistics in India reveal that the maximum number of accidents occur during the monsoon according to data from the Transport Research Wing of the Union Ministry of Road Transport and Highways, there had been 8,014 mishaps, and 779 human beings had been killed in 2017 whilst in 2016, there had been There have been upwards of 6,902 injuries and 714 fatalities because of street injuries. Rain does boost bad visibility, that's a not unusual place motive for roadway injuries.

Rain does increase poor visibility, which is a common cause of roadway accidents. Outside the vehicle, water splashing up can prevent drivers from clearly seeing the cars in front of them or even the road. Heavy rainfall decreases visibility even more. Inside a car, rain can cause home windows to grow to be foggy, which additionally decreases visibility. A vehicle must have good windshield Wipers and a functioning defogger to assist hold visibility, as that is the motive of many injuries requiring drivers to be seeking the assistance of auto accident attorneys. Wet roads are quite often slippery. Even roads with inside the high-quality situation can turn out to be slick at some point of a rain typhoon for loads of reasons. A layer of water at the roadway reduces tire traction, causing automobiles to slide. Oil from The motors that travel the roads can increase at the road. During the first portion of a rain shower, those surface oils are Loosened and create a greasy-kind riding floor that can be

surprising to many drivers. In colder weather, precipitation may fall as rain however flip to ice, growing risky using conditions. To avoid rain-related crashes, attorneys who handle auto accidents advocate that each one's drivers need to be privy to the precise statistics about moist roads and make sure to know appropriate driving skills for such situations. Another main hassle happens while rain water collects at the roads, which can cause vehicles to hydroplane. This is wherein rain causes a layer of water to accumulate among the tires of an automobile and the street, inflicting a lack of traction that stops the automobile from responding to the driver's control. Basically hydroplaning causes an automobile to slip uncontrollably at the roadway. This causes an apparent chance to others on the road. Our office recently handled a non-public harm declaration from a motor car accident wherein a driver whose automobile hydroplaned on rain water and crashed into our client's car seriously injuring her. That different motive force became deemed to have been riding at a risky pace for the weather conditions and was found to be responsible for causing the accident and our client's injuries.

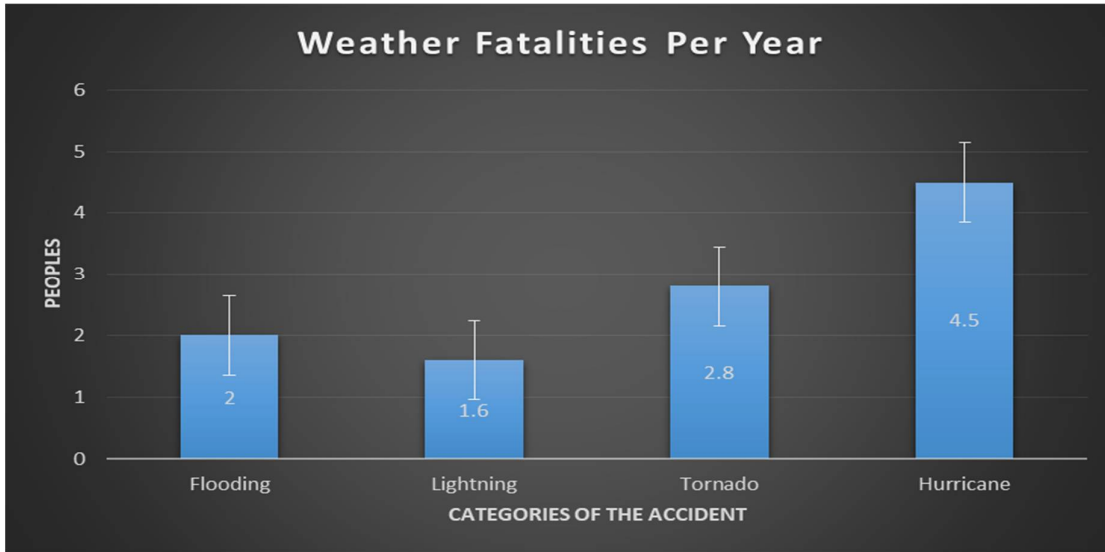


Table.1. Shows road accidents statistics on the basis of weather conditions

VI.FLOW CHART

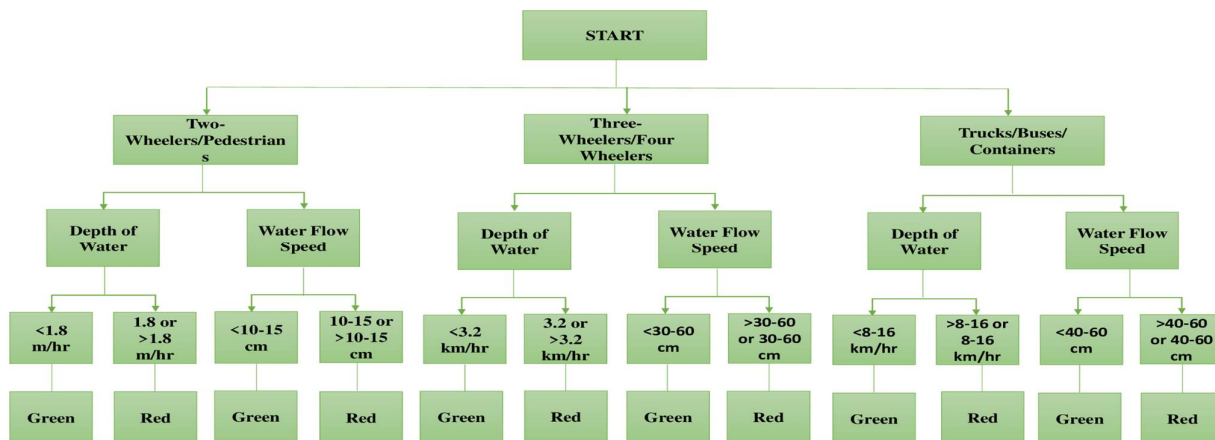


Fig.1. Shows flow chart of working system

VII. RESULTS

A standard automobile will lose energy in depths extra than 15cm as water enters the exhaust and washes into the air intake, causing it to drift as soon as flood stages exceed 30cm. Modern vehicles with electrically powered home windows and locks are

nearly not possible to get away from as soon as water reveals its manner into wiring and motors, disabling switchgear and urgency on the bodywork. Owners of off-street motors should not count on their immunity, because the fast-flowing pressure can triumph over four-wheel force or another device at their disposal. Even if we have the good fortune to survive getting caught in a flood with a car, the damage the vehicle will certainly suffer will make the owner regret taking the chance. Motorists who try to pass those flooded low-water crossings are setting themselves, their motors, and other occupants in their motors at lethal risk. To avoid this ss we have got the depth and water flow speed of the flooded water flowing over the bridge, if the water flow speed and depth of water are undesirable for any of the vehicle categories then the red signal will get turned on and on the other hand, if the water flow speed and depth of the water are normal then the green signal will get turned on. Generally, for pedestrians & bikes with the water flow speed of 1.8km/hr & water depth of 10-15 cm its not possible to cross the bridge, for three wheelers & four wheelers water flowing with the speed of 3.2km/hr & water depth of 30-50 cm it's not possible to cross the bridge, similarly for trucks/buses/containers water flowing with a speed of 8-16km/hr & water depth of 40-60 cm its not possible to cross the bridge.

Type of Vehicle	Water Flow Speed	Depth of The Water Flow	Signal	Allowed/Not Allowed
Bikes, Pedestrians	1.8 m/hr	10-15 cm	Red/Green	Red: Not Allowed Green: Allowed
Four-wheelers/Three-wheelers	3.2 km/hr	30-60 cm	Red/Green	Red: Not Allowed Green: Allowed
Trucks/Buses/Containers	8/16 km/hr	40-60 cm	Red/Green	Red: Not Allowed Green: Allowed

Table.2. Shows information about type of vehicle type with undesirable water flow speed & depth of the water

VIII. CONCLUSIONS

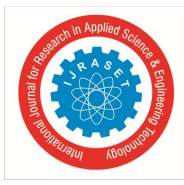
- A. Flowing water applies pressure to contact areas. The higher the speed the higher the pressure.
- B. With water this is one meter excessive it'll float out at a pace of 4.forty seven meters in line with 2nd or sixteen km/h The pressure is one metric ton per square meter.
- C. For the 4 wheels it turns into one and a 1/2 of lots and for 2m of water it turns into 2 ton in line with sq. m..
- D. Be careful, water that has fallen only 0.4m reaches a speed of 3.2 km/h and can sweep your car off a road bridge.
- E. Be careful, 0.6 meters of water can float a car. Only motors which might be open and allow the water via will behave differently.
- F. Establish the frame region of the car and its mass. From this calculate how deep the vehicle will sink in the water before it floats. For a truck that is 8.5 meters long and 2.5 meters wide and with a mass of 12 ton it will float at a level of .532 meters above The frame base and be capable of gliding down the river.
- G. It's a project to face in waist-deep water flowing at most effective 1m/s. By 1.8m/s (4mph) anybody is washed off their feet.
- H. A mere egg cupful of water can be sufficient to damage an engine.
- I. Don't force into flood water that's transferring or extra than 10cm (four inches) deep. Drive slowly and step by step so that you don't make a bow wave.
- J. Just 30cm of flowing water can be sufficient to transport your car.

IX. ACKNOWLEDGMENT

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