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ROAD ACCIDENTAL ALERT SYSTEM

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Abstract - Over 10000 lives are lost in fog related road crashes every year in India. Road accidents due to fog are becoming a cause of concern as, in past 4 years, fog related road fatalities in India have risen almost 100 percent. But an underseen fact is that the inceptive accident is just the tip of iceberg and the real hazard is posed by the multi vehicular pile up that follows. This project is designed to resolve this issue of multi vehicular pileup. Basically, this project adheres to the principal of constraining losses to the initial. The "Road Accidental Alert System", abbreviated as "RAAS" constitutes a number of sensors installed in pre-defined and uniform distances, that detect a vehicle which tends to be in rest position for more than 30 seconds on road, and consequently initiate glowing of SOS lights so that the driver of the upcoming vehicle on the same route will get an alert signal and he can control his speed as well as the steering of vehicle. This project is just a prototype or beginning of a grand idea, which if shapes to efficiency can transform the road accident data, by completely removing a category of cause of accident.

***Key Words*: RAAS, Road Accident, Multi Vehicle pileup, Accident prevention, Alert System, etc.**

1.INTRODUCTION

In India vehicle accidents claim the lives of more people than many other factors. It is one of India's significant losses due to natural catastrophes or human carelessness [1]. This leads to significant family sorrow, loss of income for dependents, and long-term or brief discomfort. It has been noticed that the rate of accidents is greater in the months of December and January. Fatal crashes related to fog or smoke occur frequently in Northern India, which ranks high among all cases in winter season in terms of crash fatalities [2]. This tendency has no clear cause; however, it might be related to poor or low visibility (fog) during the winter months [3]. Our motivation behind doing this project is to reduce and minimize the number of road accidents happening on Major Indian highways and roads due to foggy or low visibility weather conditions [4]. Main principle of our idea is to alert drivers on highway specially on foggy days when there is low visibility. Our project “ROAD ACCIDENTAL ALERT SYSTEM”, abbreviated “RAAS” does this work quite nicely [5]. According to our idea, there would be a number of sensors installed in pre-defined and uniform distances so that they can detect a vehicle which tends to be in rest position for more than 30 seconds on road resulting in glowing of SOS light so that the upcoming vehicle will get an alert signal and they can control their speed as well as a steering of vehicle [6].

Road traffic accidents claim the lives of four times as many people in our country as terrorism does globally [7]. According to data, almost 4.5 lakh people died in 2019, with around 414 people dying every day.

Table-1: Overview of road accidents and affected persons

Year	Total Number of Road Accidents	% Change	Total number of Persons Killed	% Change	Total Number of Persons Injured	% Change
2015	501423	-	146133	-	500279	-
2016	480652	-4.14	150785	3.18	494624	-1.13
2017	464910	-3.28	147913	-1.90	470975	-4.78
2018	467044	0.46	151417	2.37	469418	-0.33
2019	449002	-3.86	151113	-0.20	451361	-3.85

Over speeding, drinking and driving, overloading, high-speed vehicles, young drivers without a driver's license, and not focusing while driving were all factors in the majority of the events [8]. Fog has been known to cause major traffic safety and flow concerns owing to poor visibility. Fog is a bad weather condition that causes limited vision and has a big influence on driver behaviour and traffic safety. Every year, fog causes roughly 30000 crashes in the India [9] Both Road accidents & number of accidents related deaths under different weather conditions have decreased in the year 2019 as compared to 2018 except for “Foggy & Misty “category of weather condition. The maximum increase in road accidents (19.9%) and road accident deaths (13.2%) has been under the weather condition “foggy & misty” weather condition as in table 2 below [10]. Using a driving simulator, the implications of reduced vision in foggy and hazy weather on collision risk and car following behaviour are assessed [11]. Following are the major findings:

Table-2: Overview of weather condition and road accidents

Weather Condition	No. of Accidents			Persons Killed			Persons Injured		
	2018	2019	% Change	2018	2019	% Change	2018	2019	% Change
Sunny/Clear	348137	330295	-5.1	104883	103765	-1.1	356594	339636	-4.8
Rainy	44011	39825	-9.5	14590	14240	-2.4	45010	39573	-12.1
Foggy& Misty	28026	33602	+19.9	11841	13405	+13.2	25265	30776	+21.8
Hail/sleet	4114	4043	-1.7	2123	2036	-4.1	4080	3945	-3.3
Others	42756	41237	-3.6	17980	17667	-1.7	38469	37431	-2.7
Total	467044	449002	-3.9	151417	151113	-0.2	469418	451361	-3.8

(1) When the weather is foggy, the overall collision risk is much higher than when the weather is clear.

(2) Under the high-speed stage, distance and time headways are much shorter in foggy weather circumstances than in clear weather conditions.

(3) Under high-speed and middle-speed stages, speed variance is larger in foggy weather circumstances than in clear weather situations.

Many technological systems for detecting and monitoring driver tiredness levels are in the research, validation testing, or early deployment stages right now. Previous studies have looked at many technologies and methodologies for detecting and predicting tiredness [12]. A suggested intelligent automobile system for accident avoidance. The Vehicular Backbone Network (VBN) structure can be used to propose a Road Accident Prevention (RAP) method [13]. The RAP programme seeks to stop automobiles from becoming involved in highway traffic accidents, lowering death and injury rates. RAP instantaneously activates a highway road traffic accident prevention plan if the potential of an emergency circumstance (i.e., an accident) is foreseen in advance [14]. The objectives of this project are: -

- To reduce the rate of accident in foggy or low visibility weather condition.
- To reduce the financial losses to economy.
- To preserve valuable lives of innocent citizens.
- To develop a strong and solid hardware-based solution keeping in mind the various parameters:

  a. Feasible

  b. Economical

  c. Reliable

  d. Versatile and implementable

  e. Unsophisticated

  f. Environment friendly

2. Method

The Indian Roads, basically Highways swarm of caravans of vehicles all sizes and Shapes. North Indian cities of Punjab, Haryana, Delhi NCR, Uttar Pradesh, etc. majorly undergo severe fog conditions and visibility block due to haze and air pollution [15]. Due to such conditions, horrific accidents occur. This may include a vehicle colliding with an obstacle and consequently a disastrous multi vehicle pileup [16]. Low visibility is the prime reason for multiple pileups.

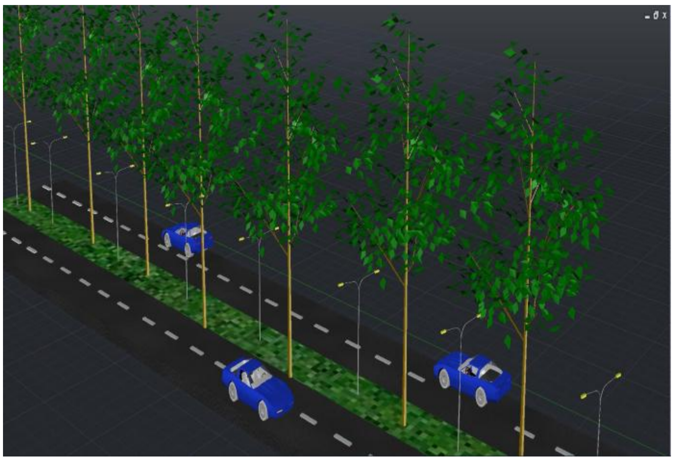

Fig-1: Schematic visualisation of RAAS (Z- axis)

A stationary decimated vehicle laying on the pavement, is an unexpected upcoming misfortune for vehicles coming towards it on the same route with the same haste, as they were not able to assess when to slow down or stop [17].

"RAAS" is based on the principle of providing a visual alert to whatever sane thing is reaching an accident site, unknown of it, beforehand [18]. When the driver inside a vehicle approaching an accident site during low visibility condition will see the S.O.S. light of "RAAS" blinking in the sideways, he/ she can assess that some mishaps have happened within a pre-determined radius, and can accordingly slow down [19].

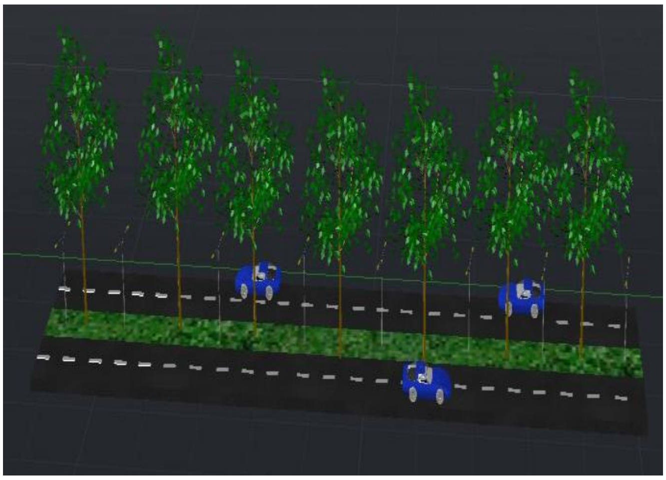

Fig-2: Schematic visualisation of RAAS (X- axis)

2. WORKING

The "RAAS" works in consequence of various sequential events: -

STEP 1
(NO TRAFFIC CONDITON) (NO ALERT)

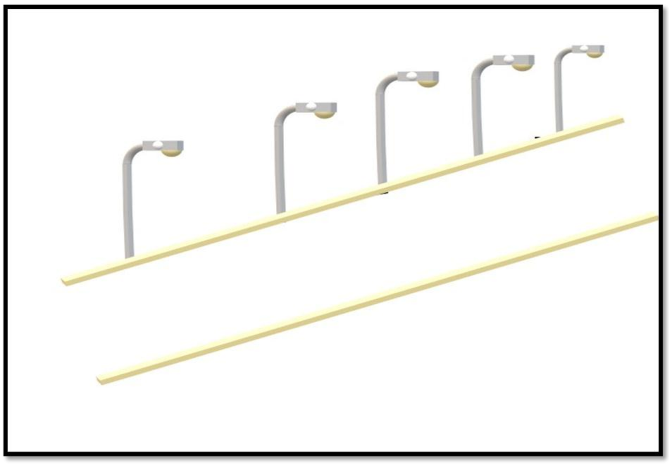

Fig-3:NO TRAFFIC CONDITION

When the roads are clean from motor vehicles, or no such significant movement is observed, the sensors remain inactivated and there is no warning issued through SOS lights. This is the general situation. This is because the receivers will not receive a constant signal for 30 seconds, as there are no vehicles to emit signals [20].

STEP 2
(STEADY TRAFFIC CONDITION) (NO ALERT)

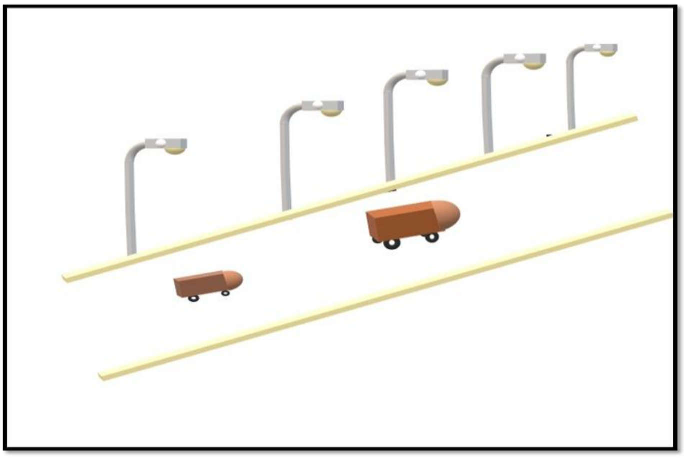

Fig-4: STEADY TRAFFIC CONDITION

When the traffic is locomoting at its standard velocity and no any obstruction is present, the sensors remain inactivated and there is no warning issued through SOS lights. This is an everyday casual situation. This is because the receivers will not receive a constant signal for 30 seconds, as the fast-moving vehicles will surpass the receiving range of any receiver that's accumulating the signal, within the timeframe of 30 seconds [21].

STEP 3
(ACCIDENT HAPPENS) (TIME = 0 Seconds) (NO ALERT)

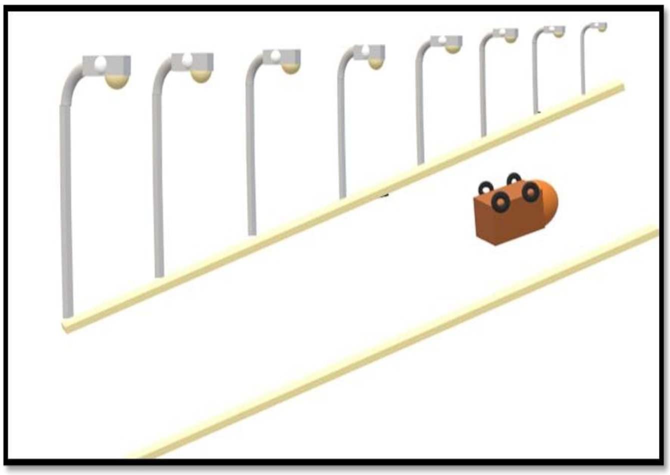

Fig-5: ACCIDENT HAPPENED 0 SECS

Assume a situation that weather is foggy at night and visibility is very poor. Now suppose an accident happens, i.e., a car collides with the divider or a car bump into another or a vehicle skid and topples due to a slippery road. The vehicle will remain stranded on the carriageway until it is cleared by the authorities, if it is rendered unmotorable. The vehicles coming in its direction at a gap of 15 minutes are unaware of the calamity that happened. Due to low visibility, it is very difficult for them to see it unless they reach very near to it. Very high-speed vehicles are often liable to collide with the debris of the accident victim vehicle or any other obstruction [22]. In this situation if "RAAS" is installed, the signal being emitted by the broken car's transmitter is grabbed by the sensor's receiver in whose radius the car falls. For next 14 seconds even if the receiver is getting a signal, it will not trigger the alert. This is programmed so because there are chances that a car stops for some intentional purpose.

STEP 4
(ACCIDENT HAPPENED) (TIME = 30 Seconds) (ALERT ISSUED)

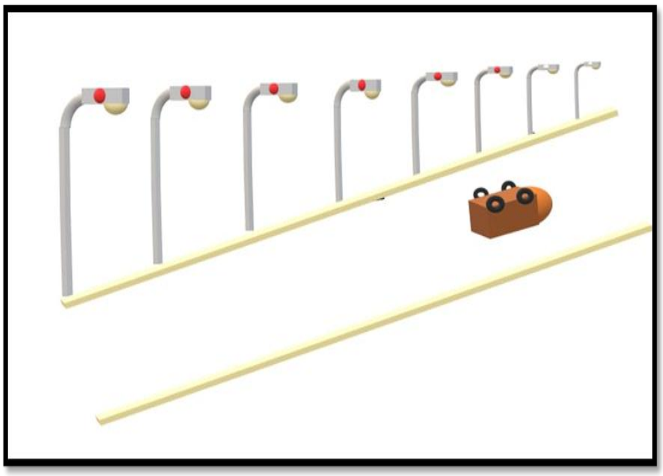

Fig-6: ACCIDENT HAPPENED 30 SECS

Now suppose there is an actual accident. A car collided in the side boundary and is laying on the pavement. The car is in the radius of a receiver is continuously catching a signal which is being transmitted by the broken car. The time frame of 30 seconds gets over and the same signal is being still recorded by the receiver [23]. The system will automatically assess that some kind of obstruction is present at that road which can be hazardous to the high-speed traffic following back. The sensor will initiate the circuit to trigger an alert by activating the high frequency SOS lights installed in the street light head section. Alert lights of half a kilometer backwards will be activated. This will be a notification to the lagging traffic that some danger is ahead [24].

STEP 5
(TRAFFIC NOTIFIED CONDITION) (ALERT ISSUED)

After the alert system is activated, it is normal for upcoming commuters to judge the alert as a warning sign. Any driver who sees the alert light is cautioned that in half a kilometer vicinity there has been an accident and he/she is prone to a multiple pile up situation. In its response he will voluntarily slow down very gradually and move at a pace in which it will be possible for the driver to see and stop immediately if the obstruction comes Infront of it. In this way there is very heavy possibility that the driver who viewed the alert will be saved from colliding into the previous accidental vehicle.

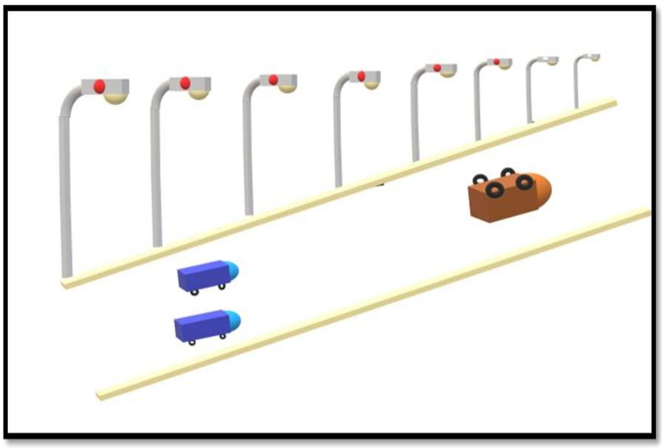

Fig-7: TRAFFIC NOTIFIED CONDITION

3. MECHANISM

Radio Frequency (RF) – Transmitter (T_X) & Receiver (R_X), can be customized for any frequency or Range. Normal 434 MHz frequency radio waves can work in all directions up to a range of 100 m (means surrounding). If encoder and decoders be used with these receivers and transmitters, we can get simplified data for upside going traffic and similarly for the downside traffic as well. When the car is moving, it continuously transmits a certain frequency wave which is received by the receivers present in the pole. This process will continue when the car keeps moving but when it stops on or between any pole then the receiver starts decoding the encoded data sent by transmitter module. Then finally if the data streak continues for 30 seconds, a timer circuit and a digital control circuit triggers an alert by lighting up the SOS life of next 10 poles. This will alert the vehicles coming from behind.

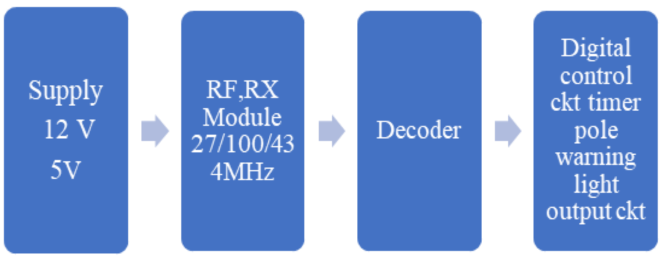

Fig-8: Circuit block diagram for Pole (Receiver)

Fig-9: Circuit block diagram for Car (Transmitter)

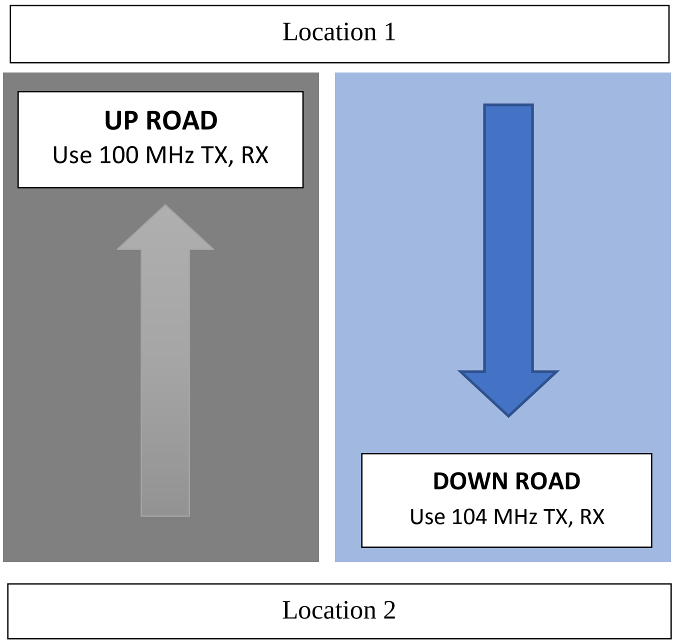

Fig-10: Schematic for dual frequency travel

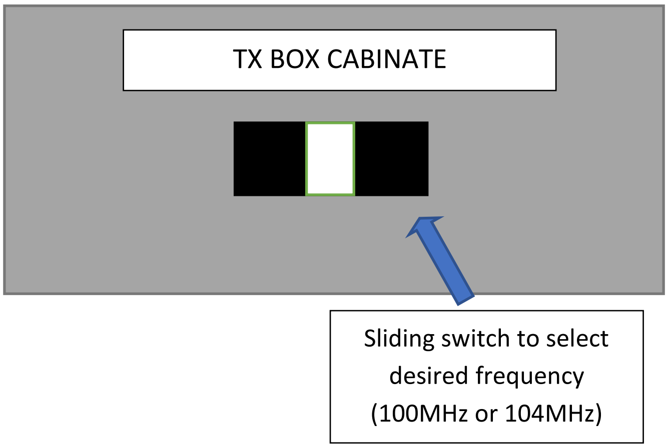

Fig-11: Frequency switch

4. MODEL

The images of the working model of RAAS system are provided below. It is a protype of the proposed system. It portrays a section of road on which RAAS is installed. Its shows the street lights and the control unit which holds the complex internal circuitry.

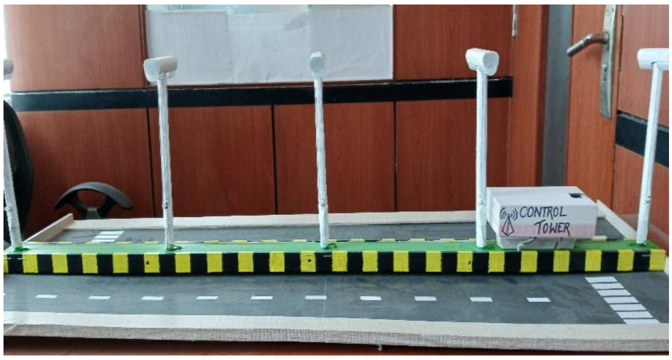

Fig-12: Road Accidental Alert System (Model)

Fig-13: Control Box

Fig-14: Road Accidental Alert System (Model)

5. COST ANALYSIS

The cost analysis includes detailed cost breakup of the various components installed in the model as shown in table 3. This is the cost of just the model. The total cost incurred on setting up the whole model is 2305 INR.

TABLE -3: COST BREAKUP

S.NO.	COMPONENTS	SPECIFICATON	QUANTITY	COST INR
1	PCB (Printed circuit board)	3.825"-Length 1.6"-Width	1	300/-
2	SUPPLY (Adapter)	12V	1	200/-
3	REGULARTOR IC	5V (7805)	1	20/-
4	MOSFET	P5506	1	30/-
5	TRANSMITOR	BC (547)	2	30/-
6	IC	NE 555	1	20/-
7	CD	4060	1	40/-
8	CD	4013	1	40/-
9	CAPACITOR	A) (ELECTROLYTE) 47μF/25V B) (CEREMIC) 0.1μF	4 3	20/- 15/-
10	RESISTANCE	22KΩ 10KΩ 2.2KΩ 330KΩ 330Ω 1KΩ 470KΩ 1MΩ	7 5 1 1 2 1 1 1	150/-
11	ZENOR DIDODE	1mV (4148)	4	20/-
12	CONNECTOR	12V (FEMALE)	1	20/-
13	BATTERY	9V	1	30/-
14	WIRING HARNESS			200/-
15	LED LIGHT (SOS)	GREEN LIGHT	5	150/-

	IR MODULE (INR)	QUANTITY USED IN MODEL	AMOUNT
RECIEVER (POLE)	200/-	5	1000
TRANSMITTER (CAR)	20/-	1	20

TOTAL AMOUNT OF MODEL	**2,305/-**

6. CONCLUSIONS

The project completed its task of preliminary design of a much-needed safety and alert system for Indian roads, that can be used to mitigate the problem of multiple accidents and multi vehicle pile ups due to reduced visibility because of fog or mist. Due to lack of resources for grand level implementation at such a novice level, full-fledged testing and efficiency data cannot be produced. The project, "Road Accidental Alert System", accomplished its purpose of becoming a prototype and setting up a base for development of a system in future that can be immensely effective in preventing accidents due to such petty issues of low visibility. Which can be avoided by little scientific hard work, and if possible, would be able to eradicate a category of cause of accident in the table of causes of accident.

7. Future Scope

"Fleeting of time leaves behind a trail of Advancement in innovation". With this in mind there is a hope that, the areas where improvement can be done in this project are: -

Finding a way to make it a one-way system by removing the car module.

This can be done by using innovative technology in sensors and motion and static detection.

Integrating it to GPS navigation to automate frequency switch issues.

Designing radiation segregators to reduce wave interference.

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