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Real Time Accident and Breakdown Alerting Systems: A Survey

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Abstract: The accident alert and breakdown systems described in our paper employs an embedded system approach. This system enables efficient protection during the time of accident and also alerts the nearest hospitals via cloud. It also uses GPS and GSM technologies to detect the exact location where accident has taken place, once the location is known it then alerts the nearby hospitals to send help to the specified place. Further, this system alerts the driver during any breakdown and sends proper guidance to turn off the engine thus protecting many people from damage. Thus, this paper ensures the safety of the passengers in the best possible way using several modern technologies.

Keywords: Global Positioning System(GPS); Global System for mobiles (GSM); Evolution Data Only/Evolution Data Optimized (EVDO); Radio Frequency Identification Technology (RFID); Real time locating system (RTLS)

I. Introduction

Transport plays an important role in a country's economy. Despite improvement in the sector, several properties of transportation are still redundant with problems that arises due to outdated facilities and infrastructure. Among these are: 1. Non-availability of transportation unit during the peak hours, which results in overcrowded vehicle and discomfort for passenger. 2. Non-accessibility of most of the public transportation in villages. 3. Uncertainty of delay time due to traffic jams. 4.Abnormal conditioning. In the existing transport systems, different tracking techniques are employed for real time tracking and arrival time prediction using technologies such as Google maps integration, automatic transit directions and Global Positioning System (GPS). Few transmission mechanisms include SMS, GPRS, satellite or terrestrial radio from the vehicle to a radio receiver.

Section 2 presents literature survey on existing transportation systems. Section 3 presents the proposed intelligent transport system. Section 4 provides the discussion and suggests the improvements. Lastly, section 5 concludes the paper.

II. Literature Survey

Kiran et al.[1] proposed a system that monitors and alerts the accidents by locating vehicle with the use of GPS and a Raspberry Pi as an interface device. When an accident occurs, it is determined using various sensors and is processed by the use of microcontroller where the actual information is processed together with the accident location of the vehicle. Using the cloud and internet, the information is transmitted to the hospital. The working methodology of this system is demonstrated as follows: The piezoelectric sensors detects the accident by using a predefined threshold value. The output is when threshold is exceeded is given to the microcontroller. The GPS system gives the latitudinal and longitudinal angles of the vehicle and is sent as message through GSM. The static IP address of main emergency dispatch server is preserved in EPROM, and whenever an accident occurs the position is detected and a message is sent to preserve static IP address.

Ramya1 et al.[2] presented an alerting system that deals with providing sound safety and security of the transport vehicle by constructing an embedded system for vehicle indoor and security while changing and interfacing the existing modules. This monitor the amounts of poisonous gases such as Co, LPG and alcohol inside the vehicle and gives out an alert information in the form of alarm. It also sends an SMS to authorized person through GSM. The obstacles are detected by using IR sensors and thereby collision is avoided from static vehicles. This system works by placing TR modules in front of the vehicle and detects the obstacles ahead, alerts the driver and gives alarm thereby avoiding accidents. The gas sensor that is mounded inside the vehicle detects the high emission of alcohol, Co_2 and such other gases, upon the accident and sends an SMS to the authorized user through GSM.

Spurti et al. [3] focused on IOT (internet of things) to give fatality reduction benefits in an cheap price, and to provide situational awareness and emergency response. This system uses ABEONA algorithm to help the driver to change the path when an accident is detected, such that traffic is maintained properly. It also uses on board diagnostics (OBD) devices and android based smart phones to provide smart transport system (ITS). An android application is proposed which uses the concept of gravity using OBD-II interface when a gravitational force is experienced by the passengers in collision with air bag.

Andrea et al. [4] enlighten on smart city development, and developed an IoT technology, to controltraffic congestion in cities . In contrast to the existing systems which mainly used camera, the new system installed GPS system on modern vehicle to monitor the traffic. This system also adopted a combined environment for air quality and acoustic nature along a road. This technique provides proper information for city authorities and citizens to manage land disciplines and to send ambulances wherever needed. The system also shows the shortest possible route to reach the destination.

William et al. [5]presented the concept of FMS (Freeway Management systems) which is an incident management program and includes surveillance of traffic jam , communication system and a control centre so as to efficiently manage the traffic properly. CCTV cameras are used in this concept to capture the image of traffic. The images are sent to the control department for surveillance of the traffic such that major accidents, breakdowns etc. can be properly sensed and proper decisions can be taken. For this use, the FMS has the algorithm which checks if the flow of traffic exceeds at the major places. Using the image sent by the CCTV's, emergency vehicles can be sent to that places. Accidents may be like vehicle breakdown, breakage of roads, collapsing of the bridges or accidents at the roads. A detector has been included in the monitoring system of FMS, to identify the traffic issues. Various sensors such as infrared sensors, microwave sensors, ultrasonic sensors and many more are placed on roads.

Chris Thompson et al. [6] proposed the usage of Smartphone to identify the accident. Smartphone are often used as a unit of wireless mobile sensor network. It captures the data provided by the GPS, accelerometer, and sensors, compasses the vehicles, detects the accidents and records the various information relating accidents. It mainly uses the concept of G force that has been experienced by the user. This paper, also developed a mobile application to automatically detect accidents, the app is called as Wreck Watch. It notifies the Smartphone users about the accidents and thus the family users become aware of the accidents very efficiently and easily, sensors are placed inside the Smartphone, when the acceleration of the vehicles exceeds certain threshold it awakes the control servers using the 3G connection built in the phone.

Sreeja VS et al. [7] proposed an idea is an integration of accelerometer GPS, GSM. An accelerometer detects the fall herby detecting the accident this information is processed along with the information of the latitude and longitude produced by the GPS .Based on the speed of unit and threshold algorithm the event is decided as accident or not .A short message consisting of location of the vehicle is sent via GSM module. Here the system aims at giving high performance by using a 16 bit MCU to store the signal of the accelerometer .Thus device act as a black box .Hence after the occurrence of the accident this system can be removed and studied the course of accident by police officials and insurance company .the system can store the events that had occurred one minute before the occurrence of the accident.

Jorge Z et al. [8] compared the previous technologies and the existing technologies. Earlier technologies have used the concept of advanced traffic management system (ATMS), which also included the accident detection system and the notification of accidents. The concept of ATMS uses traffic sensors which are used for traffic surveillance and used to detect the accidents if any. The traffic sensors are mainly placed on highways, and are also installed on the roads to detect accidents. The cost of installation is high since it needs lot of sensors. These sensors installed on the roads can be affected by the climatic conditions and can generate wrong outputs. Notification system cannot be installed in each vehicle. It can only be available for recent vehicles because recent vehicles provide on board sensors which are absent in early days' vehicles. To overcome this problem, Wreck Watch concept that has been implemented to provide accident detection and notification using smart phones and to interface related communication.

Bannister G et al. [9] aimed to limit the occurrence of wrong outputs and improve the accuracy of Wreck Watch. This system is called CADANS, ad has the following advantages: a) CADANS gives a confirmation popup window which allows the user to confirm about the accidents if any, thus if any false stream has been generated, the alarms can be cancelled and notifications are ignored. b) CADANS allows the user or the other person who have seen the accident to take the pictures and the videos and send to the emergency contacts and inform the control unit. c) CADANS uses Smartphone's camera to take videos and send it to the emergency contacts and control unit as a proof of the accident. This system is very useful as it alerts the family members and emergency contacts via SMS which usually contains all the detailed info along with the accident happened location.

Hamid M. Ali et al.[10], have proposed a system called CADANS which mainly have two parts to perform - a) the detection phase, the main purpose of this phase is to detect the accidents and b) notification part which mainly notifies the emergencies units like hospitals etc. about the accident as fast as possible. In detection phase, the pictures of the accident are captured via the, GPS receiver, Smartphone accelerometer sensors and inbuilt inside microphone to detect if there is an accident. Smart phones and acceleration sensor that uses the concept of gravity experienced by the user also GPS values is used to calculate the acceleration of the vehicle,

by the help of vehicle speed we can know about the vehicle if it is probable to accident or not. Via Microphone the accidents can be detected more accurately as it combines the data of GPS and accelerometer sensors.

Shailesh Bhavthankar et al. [11] aimed at detection of accident by use of microcontroller, MEMS accelerometer, GPS, GSM, Temperature sensor and alcohol sensor. The main function of the accelerometer is to detect the acceleration of the vehicle. When an accident is detected it is reported along with location provided by GPS and by using the GSM module the controller sends the message to the family members of the victims. The temperature sensor is provided to detect the temperature of the transport unit. The alcohol sensor stops the engine when driver consumes the alcohol thereby preventing the accidents. The gas sensor is used to detect the toxic gases that are released by engine during leakage.

Victor Dugemige Matthews et al. [12], the detector sends the actuating signal to the GPS or GSM module which are programmed such a way that unique identity of the unit is fed in to locate the crashed unit efficiently. With this information, the message is sent to the CDS (communication database server). The CDS server compares the information received with mapped details in the memory. The communication database server fetches the above information along with the GPS signal and send them to the near medical centers, police stations and other centers. Here the officials of a vehicle can communicate with the embedded system present in the vehicle and find out the physical scenario of the event so the accident can be attended in faster manner.

Swathi Balaraju et al.[13] developed a system that collects the information of the vehicle motions and crash details and are stored in a device like to the black box of the airplane. Two embedded system works parallel: one for camera data recording in SD card and other for storing causalities and criticalities such as accidents and crashes. The other part of the system transmits the causalities to nearby medical institutions. All the information related to the sensor information are stored in memory with time stamp and can be retrieved with serial interface to any serial terminal software. hence, the cause and course of the accident can be effectively studied and later investigated by the GPS, GSM, UART interfaced with the microcontroller.

M Mounika et al. [14] makes pre-analysis of the vehicle and its driver. Here the alcohol sensor detects whether the driver of the transport unit is drunk or not, thereby preventing the accidents earlier. The identification of the statuses of the victims of the accidents is also possible. Here the prevention of the crash is done by sensing whether the seat belt is used or not. Along with the status of accident or crash detection, the health conditions such as blood pressure, heart rate of the victim is continuously monitored. With all the measures, the information of unit are tracked using GPS and message is sent via GSM module to the nearby hospital. Another interesting thing is that the identification of dangerous road conditions such as short curves, sharp turns are monitored by vertical 'g' forces. More the bumps higher the value of 'g' is. The driving manner is also understood with the help of gyroscopic values.

C Prabha et al.[15] aimed at detecting accidents and report the same to the preserved number that is generally stored in the EEPROM, whenever an accident takes place, the crash is detected using a crash sensor which is set with the threshold. A Piezo Electric Sensor is used for detection of the mechanical shocks and produces voltage according to the shock produced. This signal of the sensor is processed using a microcontroller which processes the accident information produced by sensors and processes the latitude and longitude information produced by GPS and sends both information through GSM as a message to pre saved number that is stored in EEPROM

III. Proposed Architecture

Based on the earlier studies carried on the various methods of tracking and alert system that uses GPS (Global Positioning System), Shock sensors system respectively. A more effective embedded system based tracking system is put forward which not only can track the transport but also can facilitate emergency such as accidents, bus breakdown, emergency that is not predictable. This paper is validated for all the public as well as the private vehicle transport system. Here the passengers are precisely provided with the tracking information of the transport for their plying so that they can effectively plan their journeys without any confusion and in reasonable time. The transport system can be easily taken care during the emergency or unforeseen cases using an effective alert system. The heart of this system consists mainly GPS and cloud computing system.

[1] Cloud Computing System:

The cloud computing system contains all the information in the form of database such as the transport timing, transport, availability, accident information, transport emergency and so on. Here cloud is used for tracking as the tracking information of the present transport unit and preceding one information are available in the cloud as the cloud is connected to main transport station which in turn is connected to all transport - units. Using this technique, the passengers can get all the information such as the number of passengers in the transport unit, timing information and delays of unforeseen travelling soon.

[2] Alert System:

There is also an emergency scenario other than the above, when the transport unit breaks down due to the engine failure, cooling system failure, tyre puncture and so on. This scenario must be taken care efficiently such that passengers on board should not be affected by the bad consequences. During this scenario, the transport system driver must call the main station for the service and need to acknowledge the main station to send another unit for the transport of the passengers. Our project replaces this by an alert system, after pressing the alert button the alert is send to the transport unit which can facilitate the emergency effectively.

[3] GPS:

GPS stands for Global Positioning System. We know that the GPS serves as a navigation tool for various applications. Location name and the GPS coordinate values are stored as a look up table in microcontroller. When alert is received, it tracks the location. Hence it serves as the connector between the main processor and cloud.

[4] Air Bag Sensor:

Air bag is an embedded system consisting of many sensors which are used for the detection of shocks, accidents etc. The air bag system consists of mainly shock sensors, crash sensors. These sensors detect severe shocks and are set to high threshold values. For smaller threshold value the sensor does not detect it as an accident, when it crosses certain threshold value the output is processed by the controller and given to cloud computing to alert the nearest hospitals and police stations.

[5] Alert Switch:

Alert switch is an ordinary switch that is a fixed on the dashboard of the transport unit. Whenever transport unit undergoes breakdown such as break failure, axle breakdown, gear problem, tyre puncture and then transport unit is in remote lace then the situation can be accessed when the driver of the transport unit needs to press this switch thereby acknowledge the main bus station to send the other transport unit and with the service people to ferry the passengers as well as to repair the transport unit.

[6] Pressure Sensor:

We know that earlier system used many types of tracking modules for effective counting of the passengers travelling the bus, to reduce the complexity of the modules and their working we employ pressure sensors inside the seats as well as on the floor of the bus, when the passengers sits on the seat the count of the passenger is taken as one and thus counting the availability of the seats in the bus. Other than the seats we place the sensor on the floor to evaluate the space occupied by the passengers as well as the leftover space ensuring the information to the outboard passengers about the space available for their journey.

[7] Microcontroller:

We know that microcontroller is a unit that processes the signal based on the program loaded on it. Here we are not only using a controller as a discrete unit but also the peripherals embedded on it. Hence controller along with the peripherals such as external memory, led lights ports is used such a board is called as Arduino or raspberry pi board. Here controller processes the information regarding to the tracking, alert and an accident by using GPS locations and make the signals available for GPS transmission.

[8] Alcohol Sensors:

Alcohol sensor is the sensor which senses the alcohol concentration of the driver hence output of which is to turn off the engine when alcohol is sensed.

[9] Temperature Sensors-

It is use to sense the burning of engine during accident during which temperature is maximum.

[10] Gas Sensors

Gas Sensor is to detect the gases during burning of the vehicle

[11] Eye Blink Sensors

Eye blink sensor is to detect the eye blinks of driver if the driver is sleeping there is no detection from sensor hence its output turns engine off

[12] The Requiremets In The Police Hospitals And Police Stations: -

When the accident is alerted the hospitals should arrange all the necessary equipment including ambulances and doctors.

The hospitals should contain a fax machine or a display machine to access the accidents.

When the accident is detected the police station chief should get the details of the tracking information of transport unit through fax or through wireless telephone (walking talking).

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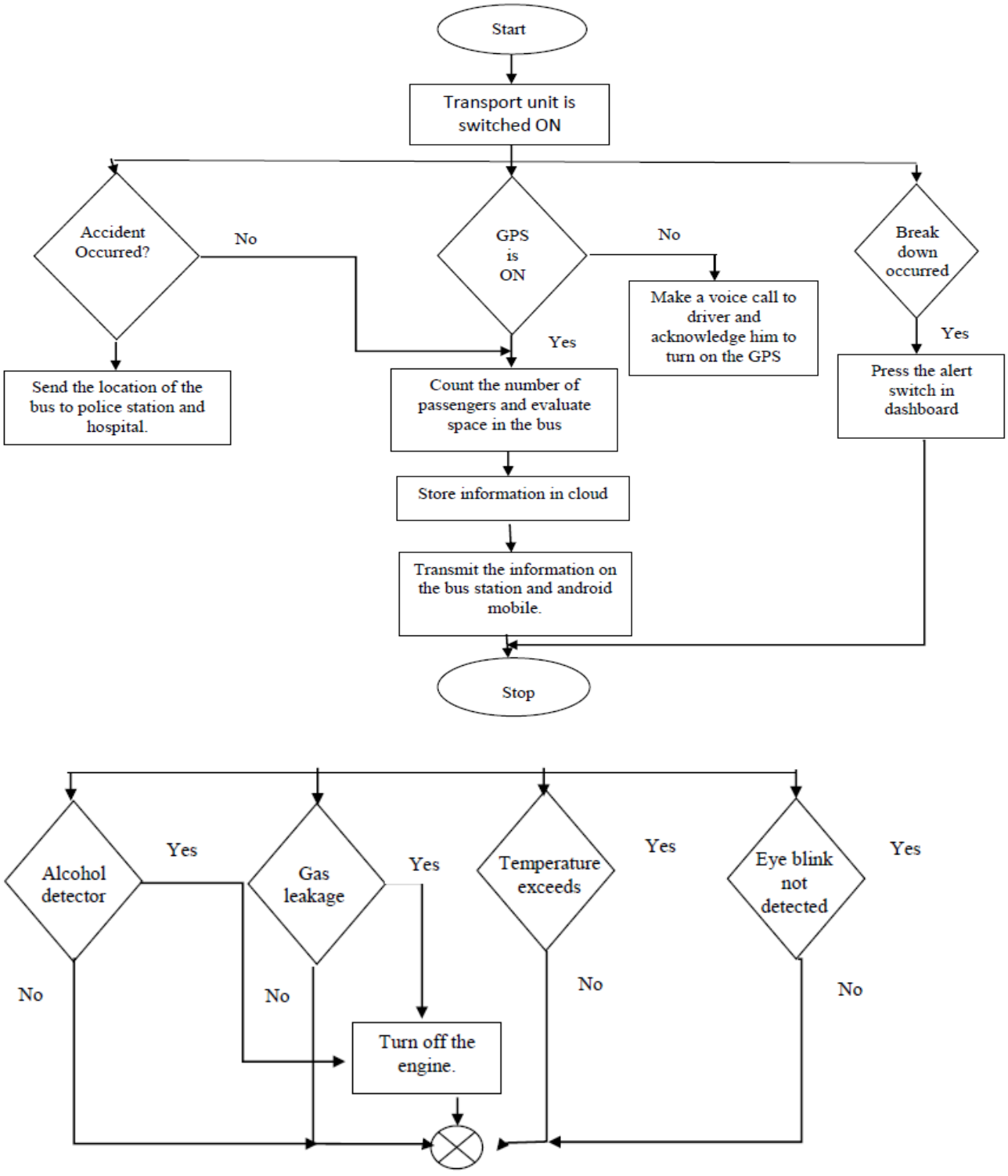
Paper	Mode of Communication	Devices used	Advantage	Disadvantage
1.	GPS,GSM, VIA IP ADDRESS	piezoelectric sensors, GPS, GSM	Communication become easier by the help of GPS and GSM.	It is costly since it uses raspberry pi as the interfacing device.
2.	GSM	IR sensors, gas sensors, GSM	Early removal Of obstacle, alarm system is provided which is useful	Use of TR module is a bit complicated.
3.	IOT, GRAVITATIONAL FORCE	on board diagnostics(OBD), intelligent transport system(ITS),Air bag	Easy working due to the use of IOT	Requires a lot of prior knowledge for this approach, thus not user convenient.
4.	IOT, GPS SYSTEM	IOT, GPS SYSTEM,SENSORS	adopts a combination of air quality and acoustic sensors along a road	Only useful in urban areas. And each person should know about IOT for this system
5.	FMS (Freeway management system)	FMS (Freeway management system), CCTV, emergency medical services (EMS)	Management of traffic become very easy, and monitoring also become very easy.	Installation cost is high and is not applicable for all the systems.
6.	GPS sensors, Wreck Watch	accelerometers, compasses, and GPS sensors	rarely incur false positives because they rely on sensors, such as accelerometers and airbag sensors, that directly detect damage to the vehicle.	Building a smartphone-based wireless mobile sensor network for accident detection system is hard, phones can be dropped (and generate false positives) and the phone is not directly connected to the vehicle.
7.	Smartphones	accelerometers, GPS, compasses	Time required is less	Since it uses network of sensors thus a bit complicated.
8.	Mobile application	traffic sensors, GSM, GPS embedded smartphone	Detection of the accidents is easy	Costly approach, applicable to detect accident via one

		sensors		means only
9.	Smartphones camera	Sensors, smartphones	User efficient, simple	differentiate between airbag deployment and benign noise is not possible, false positive signs
10.	GPS	GPS, sensors, smartphones accelerometer sensor	Easy detection of accident	Here prior toAccidents the measures are not taken, costly design
11.	GPS and GSM	GPS, GSM, mems, accelerometer, alchohol sensor, temperature sensor microcontroller	Preventive measures is taken to avoid the accident before the occurrence.	costly design, bus breakdown is not detected
12.	GPS, GSM	GPS, GSM, CDS, controller	The effective comparison of identity leads to more efficient detection	Here prior to accidents the measures are not taken
13.	GPS, GSM	GPS, GSM , memory element, controller	Leads to investigation of accident efficiently	Here prior to accidents the measures are not taken
14.	GPS, GSM	GPS, GSM, memory element, controller	The effective comparison of identity leads to more efficient detection	Here prior to accidents the measures are not taken, costly design
15.	GPS, GSM	GPS, GSM,piezoelectric sensor	Cheaper design	Accident prevention is not available



IV. Conclusion

Congestion of the traffic may happen if a vehicle stops suddenly due to some faults in the engine etc. In such cases, there should be an immediate response, like the presence of EMS (emergency medical services) which can help the persons in need and help for the easy flow and maintenance of the traffic.

But other system has the advantage that they can't generate wrong signals since they are directly connected to the vehicles and, they have sensors, air bags etc. which gets damaged directly during accidents.

The solution of this problem in our proposed system is the usage of on board sensors and physical context information to detect car accidents.

The system has many future implications like we can further improve the accuracy and power of detection which will further reduce the chances of fall, signs of accidents that are produced even if the user is outside or inside the car when it is travelling at a low speed. Also, a software that can recognize the voice that can be installed which can differentiate between air bag deployment and benign noise. If these can be installed, this system will be more accurate and useful.

V. References

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