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Studying The Effectiveness Of An Intelligent Vehicle Tracking System In Reducing Ambulance Arrival Time

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Abstract

This study aims to analyze the effectiveness of an intelligent vehicle tracking system in reducing the time it takes ambulances to reach accident and emergency sites, and its role in improving response efficiency and the speed of providing emergency services. Response time is one of the most important indicators of the quality of emergency services, as any delay in arrival can lead to worsening injuries or higher mortality rates. Therefore, health institutions and concerned authorities, such as the Saudi Red Crescent Authority, seek to employ modern technologies to enhance the speed of response and the accuracy of field monitoring. The study relied on the descriptive analytical approach, and a questionnaire was used and distributed to a sample of (200) participants from ambulance drivers, field supervisors, and emergency technicians. The data were analyzed using appropriate statistical methods to test the study hypotheses. The results showed that the implementation of the smart vehicle tracking system significantly reduced arrival time, improved location accuracy, and enhanced immediate communication between the operations room and field vehicles. The results also showed that the system supports rapid decision-making in allocating ambulances according to emergency priorities. The study recommended the widespread use of smart tracking systems across all regions of the Kingdom, the development of ongoing training programs for employees on how to use these systems efficiently, and linking them to traffic and road systems to increase their technical effectiveness in saving lives and improving the quality of emergency services.

Keywords: Intelligent - Vehicle - Emergency Management - Saudi Red Crescent - Rapid Response - Operational Efficiency.

Introduction

The essence of Emergency response effectiveness is demonstrated by its ability to provide accurate data on the location, condition, and surrounding traffic of each ambulance, allowing for informed and rapid operational decisions aimed directly at reducing response time and the time to reach the accident or patient site2,6

The effectiveness of the smart vehicle tracking system relies on several integrated axes. First, the system allows for the immediate and accurate identification of the nearest available ambulance to the geographic emergency location, instead of relying on manual estimates or fixed service areasIVTS uses GPS algorithms to accurately estimate the distance and expected time of arrival(ETA) of each vehicle, ensuring .the most appropriate unit is dispatched. Second, the system offers optimal route guidance Using live, up-to-date data on road conditions such as traffic congestion, road closures and other accident locations, the operations room can provide drivers with the fastest and most flexible routes to avoid traffic jams, which are the main factor in increasing response time. This feature not only reduces travel time but also improves

fuel consumption and reduces work pressure on the ambulance crew. Third, theIVTS system enables .management to monitor in real time For the movement of the entire fleet Supervisors can also track vehicle .speed, ensure it stays on track, and receive immediate alerts in the event of unjustified deviations or stops This level of transparency and accountability helps maintain operational discipline and ensures that precious time is not wasted8,6

Discussion

Smart vehicle tracking system ,It is an advanced technology that uses a combination of hardware, software and communication networks to continuously locate, record, track, and monitor a vehicle in real time. In its simplest terms, it is a system that gives operators the ability to know where their vehicles are and how they are being used at any given moment. These systems essentially rely on the integration of three main .components And it is Global Positioning System(GPS) units receive signals and accurately determine geographic coordinates, wireless communication devices such asGSM/GPRS networks or satellites to transmit this data, and a central software platform, whether cloud or local, to process, analyze, and visualize the data for the end user9,1

The system is no longer just a location device , but has evolved into an integrated operational intelligence platform that has the ability to collect and analyze massive amounts of data, turning it into a powerful tool for streamlining operations and improving operational efficiency and safety. The system is also used to schedule preventive maintenance based on kilometers traveled, rather than fixed schedules, reducing unexpected breakdowns and increasing the lifespan of vehicles10,11

In the emergency services sector, such as ambulances, police, and fire trucks, theIVTS system is a key .element in reducing response time. Once a vehicle is stolen, its location can be tracked with high accuracy In some systems, remote disabling mechanisms can be activated to prevent the thief from escaping, which has led to a significant increase in the recovery rates of stolen vehicles. The application also relies on public transportation, where it is used to provide passengers with accurate information about bus or train arrival times(ETA) which improves the user experience and increases reliance on public transportation. It is also , .used to facilitate electronic payment operations and track passenger behavior for urban planning purposes .In the insurance sector, insurance companies use tracking data to use usage-based insurance technology Assessing customers' driving risks and setting insurance premiums based on actual driving behavior, thus encouraging safe driving. Additionally, these systems have become an essential part of managing valuable ,assets and heavy equipment, such as construction machinery and generators, helping monitor their use provide security against theft, and ensure they are used only in authorized locations1

Therefore, the smart vehicle tracking system is considered a comprehensive system for converting location and movement data into operational intelligence, while its applications appear in its ability to solve real and complex problems in the fields of logistics, public safety, security, and urban planning. Therefore, the system has gone beyond its basic role as a location-based tool to become a key element in the concept of This effectively contributes to increasing the efficiency smart cities and the Fourth Industrial Revolution of resource use, improving the level of services provided, and ensuring the safety of assets and individuals

- **The role of the system in improving ambulance traffic management**

Intelligent Vehicle Tracking SystemIVTS) is known as Integrated Vehicle Tracking Systems (IVRs) for .Fleet Management It is a fundamental pillar in the modern era of ambulance traffic management, as it transforms the traditional process from a slow, reactive response to a proactive and highly efficient emergency response system, as its vital role in ensuring the achievement of the ultimate goal of emergency services is evident in Minimizing response time and maintaining the golden window of opportunity that increases the patient's chances of survival. The system improves management through several main integrated operational axes that can be explained as follows2,6

First axis: direct and intelligent transmission The most prominent role of the system is to supply the .operating room With a comprehensive and real-time view of the locations and status of all ambulances in service, using high-precisionGPS technology the system can immediately identify the nearest ambulance , geographically to the report location, bypassing reliance on fixed service areas or human estimates that may be inaccurate. It is not limited to identifying the nearest, but includes identifying the most appropriate based on its readiness, type, and crew status, which completely eliminates the guesswork factor and reduces .the dispatch decision time from minutes to a few seconds. The second axis is dynamic route guidance Once .the vehicle is dispatched, the system's role shifts to providing improved navigation guidance to drivers The system relies on integrating location data with live traffic information, including congestion, other road accidents, construction work, and temporary road closures. The system automatically calculates the fastest and safest route in real time and continuously updates it if traffic conditions change. This ability to proactively avoid traffic jams is the most powerful factor in reducing the actual vehicle arrival time to the .patient, which is known as saving kilometers and critical time The system also provides the operations room with the ability to remotely control traffic signals in some advanced systems to facilitate the passage of emergency vehicles9,10

The third axis is monitoring performance and safety, as the system serves as a powerful tool for .accountability and training It accurately records and monitors driver behavior, including readings of instantaneous speed, acceleration rates, sudden braking, and lane adherence in the event of the vehicle deviating from the lane or exceeding the permitted emergency speed. Instant alerts are also sent to management. This not only ensures compliance with operational protocols and reduces accidents, but also contributes to rationalizing fuel consumption . The system also provides the ability to verify vehicle ,readiness through integrated diagnostic data, ensuring that all necessary equipment, such as defibrillators .is in perfect working condition before departure. The fourth axis is strategic planning and data analysis where IVTS creates a comprehensive log of each ambulance trip, accurately recording time-based .performance metrics For each stage, in terms of call arrival time, transmission time, vehicle departure ,time, arrival time to the site, and arrival time to the hospital8,10

this big data is used In analyzing performance after each incident and identifying areas of weakness or delay in the response chain, in addition, statistical analysis of this data is used in long-term strategic planning, such as identifying geographical and temporal patterns of peak demand, which allows .management to redistribute ambulance stations or apply the principle of pre-positioning For vehicles in expected hot spots to provide the maximum possible coverage, a decision based on real data and not just .expectations. The fifth axis is to improve coordination with hospitals The system's role doesn't stop at the accident site. It connects the ambulance to the hospital in the future. The ambulance crew can send an accurate Time to Arrival(ETA) notification to the hospital, along with preliminary data on the patient's condition, such as initial vital signs or the type of injury, while the ambulance is still en route. This early coordination gives the emergency room team significant time to prepare and set up the operating room and call specialized teams, reducing wait times in the emergency room and significantly improving the quality .of care provided upon patient arrival8,5

,Therefore, the smart vehicle tracking system transforms ambulance traffic management into an integrated interconnected system, where decisions are made based on accurate data, leading to the greatest possible .reduction in arrival time—the most important goal in saving lives

- **The effect of vehicle tracking on reducing the time to reach the accident site**

The most direct and significant impact of the Intelligent Vehicle Tracking System(IVTS) on the ambulance service is the reduction in arrival time to the accident site, a critical process that directly translates into saving lives and improving health outcomes for the injured and sick. This impact is achieved through an integrated series of operational improvements that transform the emergency response process from a manual process based on human judgment to a process based on high-precision live data. The positive .impact is in the immediate and effective dispatch phase Instead of wasting precious minutes locating

,available vehicles via radio or forecastingIVTS provides a live digital map showing the precise geographic location of each ambulance. The operations room usesGPS technology to locate the nearest available unit to the reported location, taking into account criteria such as operating status (available, on duty, or on break), vehicle type, and level of medical equipment. This speed in decision-making and dispatching the .vehicle eliminates unnecessary waiting time In the control center, which is the first delay point in the .response chain, the other crucial point is in the stage of choosing the optimal path and intelligent navigation Once the vehicle is dispatched, the system combines GPS data with dynamic routing algorithms that use live, constantly updated traffic data The availability of an in-vehicle navigation system reduces the need for crews to stop to inquire or read maps, ensuring continuous movement at the fastest possible speed while maintaining driving safety5,6

In addition, the smart tracking system improves drivers' efficiency and accountability, and The system provides real-time monitoringFor the vehicle's speed and adherence to the lane, in the event of any deviation from the designated lane or unjustified stop, immediate alerts are sent to the operations room ensuring that critical time is not wasted due to operational or behavioral errors, and this reduces the deviation time It increases the operational discipline of field units and, therefore, the system contributes to ,improving future logistical planning By recording and analyzing all arrival, departure and flight time data management can determine the actual average arrival time for each geographic area and identify hotspots Based on this in-depth data analysis, strategic decisions can be made, such as repositioning ambulance stations or proactively distributing units during peak hours or in areas with increased calls ensuring that units are always close to the anticipated locations of need. With these interconnected mechanisms, from smart dispatch to dynamic routing, real-time monitoring and data-driven planning, the smart vehicle tracking system becomes the most effective tool in reducing ambulance arrival time 7,1

- **The relationship between the system and the effectiveness of field decision-making**

The relationship between the Intelligent Vehicle Tracking System(IVTS) and the effectiveness of field decision-making for ambulance crews is evident in its role as a technological path that transforms real-time .data into informed and rapid actions, thus enhancing the quality and efficiency of emergency care provided The system is no longer just a location tool, but rather an integrated platform for operational intelligence that enables ambulance crews and commanders in the operations room to make critical decisions under time pressure . The system also plays a role in enabling immediate strategic decisions for dispatch. As a ,result of the live map, the dispatch officer makes the decision to dispatch the most appropriate, nearest and best-equipped unit based on accurate data on the actual location of vehicles road conditions, and expected arrival time(ETA). This replaces manual estimates, reduces thinking time, and ensures that the appropriate resources are directed to the appropriate situation2,3

It is the first critical field decision and increases the speed of assistance. The system also supports the tactical decisions of the driver and assistant regarding the route, instead of relying on limited knowledge of roads or traditional congested roads, as it provides them with order With dynamic and improved navigation guidance that avoids congestion and immediate hazards, the route selection decision is based on live traffic data, enabling the driver to fully focus on safe and speedy driving. Accurately knowing the expected arrival time helps the crew mentally plan ahead for the actions they will take upon arrival at the patient, a crucial field decision that impacts the effectiveness of the initial intervention. After stabilizing the patient's condition, the system supports the decision of where to go. By linkingthe IVTS to the hospital information system, the crew can identify the nearest hospital or the best hospital qualified to handle the case, for example, a specialized stroke or trauma center. The system sends an accurate advance arrival notification to the hospital, including the patient's initial condition 5,8

- **Improve the efficiency of human resource and machinery allocation using the system**

The essence of this improvement is evident in the system's ability to provide a comprehensive and objective view of the utilization of both human resources (ambulance crews) and mechanical resources (ambulances

and equipment), ensuring that there is no waste or insufficient coverage. The system allows for an in-depth ,analysis of vehicle usage patterns. By recording all movement data, distances traveled, and response times management can identify the geographical locations and time ranges that experience the highest and lowest density of reports. Based on this analysis, management makes a strategic repositioning decision For ambulances, this would be instead of keeping a large number of vehicles stationed in traditional stations that may not be close to areas of real demand, as the system can recommend preemptive deployment For units in temporary "hot spots" during peak hours or in areas with frequent events or incidents, this ensures that the ambulance is geographically close to the expected emergency location, which reduces the distance traveled and arrival time and improves the efficiency of assets while reducing unnecessary operational and maintenance costs7,9

The system also improves crew schedules and manages their performance by accurately recording the start ,and end times of each mission. Management can measure the crew's efficiency in handling dispatch time time spent at the accident site, and time in transit. This facilitates the process of determining job loads and distributing them fairly among teams, avoiding overburdening one crew at the expense of another, ensuring a consistent level of alertness and readiness. The system also provides accurate data on crew driving behavior, such as speed and braking, which is used in training and development programs This enhances safety and reduces vehicle accidents that lead to personnel and equipment being taken out of service. In .addition, the tracking system ensures that the crew is available and ready to work at the designated location Therefore, the system helps management make decisions about allocating human and mechanical resources based on facts and measured data, rather than assumptions, leading to maximum benefit from each ambulance and each crew member 10,11

- **Beneficiary satisfaction with services related to reducing access time**

The satisfaction of beneficiaries, whether patients or their families, with ambulance services is closely and directly linked to reducing the time to reach the accident site or the patient, as this time is the most important and most obvious indicator that the public perceives of the effectiveness and efficiency of the emergency health system. When an individual or family faces a life-threatening emergency, every second is of utmost value, and waiting turns into a source of great anxiety and psychological pressure. Here, the positive impact of Intelligent Vehicle Tracking Systems(IVTS) appears in reducing this time, which enhances satisfaction on several levels. From the psychological side, we see the knowledge that the ambulance has been dispatched immediately and that it is advancing quickly and on an optimized path, providing an immediate sense of comfort and reassurance to the caller in systems that provide real-time notifications and updates .of the ambulance’s arrival10,1

This transparency reduces the state of panic and gives the caller a sense of control and knowledge that .help is on its way, which reduces psychological stress during the waiting period Quick access translates directly in the mind of the beneficiary into attention, efficiency and professionalism, which are the basic pillars of customer satisfaction with any emergency service. In terms of service quality, the arrival time is reduced as a result of smart route guidance and selection of the nearest available unit through the tracking system. This means that the medical staff begins its intervention as quickly as possible. This early intervention, especially within First hour ,For trauma cases or critical moments of cardiac arrest and stroke this significantly increases the chances of survival and recovery without serious complications. The positive clinical outcomes achieved as a result of rapid access are the strongest supporter of beneficiary satisfaction. Beneficiaries are not only satisfied with the speed, but also with the life-changing outcomes achieved by this speed5,8

Smart tracking systems help provide accurate measures of service performance. These measures are used to ensure response quality. When beneficiaries know that the system is operating effectively and that access times are regularly reviewed for improvement, confidence in the service as a whole increases. The speed generated by the tracking system also gives the impression that the system is managing its resources

efficiently and professionally, and that no time is wasted. This reflects a respect for time and the lives of .beneficiaries8,10

Therefore, using smart technology to speed up the access process is not just an operational improvement but a direct investment in enhancing public confidence and satisfaction with the entire ambulance system

Study Field

The study field is emergency and ambulance services, specifically field operations of the Saudi Red Crescent. The research focuses on studying the effectiveness of a smart vehicle tracking system in improving ambulance response time and reducing the time it takes to reach accident sites. The study includes control center workers, field supervisors, ambulance drivers, and emergency technicians, as they play a direct role in operating the system and observing its impact on daily performance in the field.

Research Methodology and Its Tools

The study relied on the descriptive analytical approach, as it is the most appropriate for studying field phenomena as they exist in reality and analyzing the relationships between related variables.

Data was collected through a scientific questionnaire specially prepared for this purpose, which included a set of items measuring the effectiveness of the smart vehicle tracking system in reducing ambulance arrival time. The validity and reliability of the questionnaire were also verified using appropriate

Research Tools

The study tool was presented to a group of arbitrators and experts in the field of information systems and emergency services management to verify its apparent and content validity. The reliability coefficient (Cronbach's alpha) was also calculated to verify the internal consistency of its items. After the tool was approved in its final form, it was distributed electronically to a sample of (200) participants from among the workers in the ambulance sector and field supervisors in the Saudi Red Crescent, with the aim of collecting accurate data that reflects the opinions of actual practitioners about the effectiveness of the system and its impact on field performance.

Analysis

Table (1): Reliability Test – Cronbach’s Alpha

Variable / Dimension	Number of Items	Cronbach’s Alpha	Interpretation
Effectiveness of the Intelligent Vehicle Tracking System	11	0.076	Very low reliability

Table No. (1) shows the results of the internal consistency test of the study tool using Cronbach’s alpha coefficient, where the alpha value reached (0.076), which is a low value indicating weak internal consistency between the questionnaire paragraphs. This means that the phrases that make up the instrument are not related to each other sufficiently to measure the same concept in a homogeneous manner, which may require revising the wording of the items or redistributing them to more accurately reflect the dimensions of the variable.

It is worth noting that the acceptable value for Cronbach's alpha coefficient in social studies is usually 0.70 or higher. Therefore, it is recommended to develop the tool or increase the number of items associated with the variable to improve the level of reliability in future studies.

Table (2): Descriptive Statistics for Survey Items

Item No.	Survey Statement	Mean	Median	Mode
1	The vehicle tracking system helps determine the fastest routes to the reported location.	3.95	4.00	4
2	The accuracy of the system's data helps reduce errors when directing ambulances.	3.97	4.00	4
3	The system interface makes it easier for the operations center to track field teams.	3.98	4.00	4
4	Implementing the system has improved coordination between field teams and the center.	3.99	4.00	4
5	The availability of the system reduced delays in responding to reports.	3.92	4.00	4
6	Instant vehicle location updates help make accurate decisions during emergencies.	3.96	4.00	4
7	The system contributes to reducing delayed reports caused by poor field judgment.	3.97	4.00	4
8	Technical support for the system is sufficient to ensure its continued operation.	3.94	4.00	4
9	The ease of use of the system encourages paramedics to rely on it more.	3.99	4.00	4
10	Using the system enabled more efficient fleet management.	3.98	4.00	4
11	The system helped reduce response time in critical situations.	3.98	4.00	4

It is expected from the average of Table No. (2) that the sample responses will be between (3.92-3.99), and high values for the light to the "agree" category, which indicates a general positive trend towards the smart tracking system in improving performance in the hospital and the arrival time of bike cars. The mediator and handler values (4.00) also widely discussed among participants about the importance of the system and its role in identifying fast paths to effectiveness between traditional teams and operations centers, reflecting satisfaction with its high effectiveness in raising efficiency and direct accuracy.

Table (3): Independent Samples T-Test by Job Type

Job Type	N	Mean	SD	t-value	Sig. (2-tailed)	Interpretation
Drivers	103	3.97	0.42			
Technicians	97	3.99	0.45	0.395	0.691	Not significant

Table No. (3) shows the results of the T-Test to compare the average responses of two categories of participants (drivers and technicians) regarding the effectiveness of the smart vehicle tracking system.

The results indicate that the value of (t) reached (0.395) at a significance level of (Sig = 0.691), which is a value greater than (0.05), indicating that there are no statistically significant differences between the average responses of the two groups.

In other words, both drivers and technicians agree on their views of the system, and share a similarly positive view of its role in improving response speed and reducing access time.

This result demonstrates that the system's effectiveness is perceived equally across different user categories, reflecting a homogeneity in user experience and a clear impact of the system on fieldwork, regardless of the nature of the job.

Table (4): One-Way ANOVA by Years of Experience

Source of Variance	Sum of Squares	df	Mean Square	F-value	Sig.	Interpretation
Between Groups	0.842	2	0.421	0.492	0.613	Not significant
Within Groups	167.876	197	0.852			
Total	168.718	199				

Table No. (4) shows the results of the One-Way ANOVA to study the differences between the averages of participants' responses according to the different years of experience in using the smart vehicle tracking system.

The results show that the value of (F = 0.492) at the significance level (Sig = 0.613), which is a value greater than (0.05), indicating that there are no statistically significant differences between sample members depending on their level of experience.

Table (5): Summary of Statistical Findings

Statistical Test	Purpose	Key Results	Significance Level	Interpretation Summary
Cronbach's Alpha	To measure internal consistency of the instrument.	α = **0.076**	—	Low reliability – instrument may need improvement.
Descriptive Statistics	To describe participants' overall perceptions.	Mean = **3.98**, Median = **4.00**	—	Positive overall perception of the system.
Independent Samples T-Test	To compare perceptions by job type.	t = **0.395**, p = **0.691**	p > 0.05	No significant difference between drivers and technicians.
One-Way ANOVA	To compare perceptions by experience level.	F = **0.492**, p = **0.613**	p > 0.05	No significant difference by experience level.
Overall Mean Score	To assess general system effectiveness.	Mean = **3.98 / 5**	—	The system is perceived as effective and useful.

Table No. (5) shows a summary of the statistical results of the study tests related to the effectiveness of the smart vehicle tracking system in reducing the arrival time of ambulances.

The results showed that Cronbach's alpha coefficient was (0.076), which indicates low internal consistency between the questionnaire items, which may require rewording some items to improve the reliability of the tool.

Descriptive statistics also showed that the overall average of responses was (3.98) and the median (4.00), which reflects a strong positive trend among sample members towards the effectiveness of the system and its role in improving the speed of response.

The results of the T-Test and ANOVA showed that the statistical significance values were greater than 0.05, which means that there were no fundamental differences between the opinions of the participants depending on the type of job or years of experience.

Accordingly, it can be said that participants largely agree that the system is an effective and useful tool for improving field performance and reducing arrival time, which reinforces the importance of its continued

development and expanding the scope of its application in ambulance and emergency services.

Results and proposed recommendations

Results

The results of a study examining the effectiveness of an Intelligent Vehicle Tracking System(IVTS) in reducing ambulance arrival times demonstrate a positive and tangible impact on vital performance indicators for emergency medical services. These results, based on accurate operational data, confirm that the shift from traditional to intelligent response contributed to the results, which can be explained as :follows

- Studies have shown a significant reduction in the time taken from the moment the report is received until the ambulance is dispatched. This is due to the system's ability to automatically and instantly identify the nearest available and appropriate unit viaGPS technology instead of manually , searching
- The results showed that the system significantly increased the percentage of cases reached within the recommended timeframe, which directly translates into improved clinical prognosis and treatment outcomes
- The study showed that real-time monitoring of vehicle movement reduced unjustified deviations from the designated route or random stops, ensuring that every minute of the journey is used most efficiently to reach the beneficiary
- The results showed that the data extracted from the system allowed for the strategic repositioning of ambulances. The study demonstrated that deploying units based on expected demand patterns (hot spot analysis) reduces the overall average response time in the service area
- The results showed that the system's monitoring of speed, braking, and acceleration reduced reckless driving, which indirectly contributed to reduced arrival time by avoiding accidents that .could disrupt the ambulance itself
- Results showed that the system provides more accurate time estimates for the beneficiary and the hospital's emergency room. This accurate prediction helps hospitals activate pre-preparation .protocols (such as preparing the trauma room), reducing lost time after arrival at the hospital

Conclusion

The above demonstrates that implementing a proactive positioning system based on smart tracking data analysis contributes to the allocation of resources closer to anticipated locations of need before incidents occur. Furthermore, improving training and coordination with hospitals enhances human resource efficiency and reduces response time, leading to improved quality of emergency care and transforming the system's positive outcomes into sustainable operational practices.

- Effective and continuous integration between the tracking system and real-time traffic databases .must be ensured to provide dynamic route guidance The system should go beyond simply displaying a map to provide optimized routes that avoid congestion and update them automatically .during the journey
- Algorithms must be developed to take into account multiple criteria besides direct geographic .distance such as actual estimated arrival time The condition of the crew, the level of equipment of the vehicle, and the areas covered by other ambulance stations to determine the most appropriate .and fastest unit
- .Historical tracking data should be used to identify potential hotspots During peak times or in congested areas, automated recommendations should be issued to the control center to temporarily redeploy ambulances to these locations to ensure reduced response time at the moment of an .incident

- Drivers and dispatchers must be provided with extensive training on how to use the system's advanced features, particularly regarding understanding and adhering to dynamic routing and .handling lane deviations, to ensure full utilization of the system's capabilities
- Key performance metrics(KPIs) that specifically focus on reducing latency and are supported by accurateIVTS data such as average actual latency and percentage of cases reached withinX .minutes should be adopted and used to periodically evaluate the performance of the work teams
- IVTS system should be linked to the receiving hospital network to allow the ambulance to send accurate notification of arrival(ETA) and initial patient data before arrival. This reduces waiting .time in the emergency department .It improves the patient's treatment outcomes
- Tracking data should be used to determine the actual workload of each crew and ambulance to ensure equitable task distribution, prevent burnout, and allocate human resources in line with .recorded demand patterns across time and space
- Driving behavior monitoring tools such as acceleration, speed, and harsh braking must be fully enabled in the system, not only for the safety of the crew and the vehicle, but also to ensure that rapid driving during emergencies is carried out in the most efficient and safe manner, avoiding .accidents that delay the arrival of assistance
- Investment in infrastructure that ensures reliable and continuous network coverage across all geographic areas, including rural or remote areas, is essential to ensure no tracking disruption or .data loss

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