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PHYSICAL PLANNING FOR TRANSPORTATION IN SMART CITIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT STRATEGY

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Abstract:

Intelligent Transportation Systems (ITS) are ingrained in our daily lives and represent the transportation industry's future. They enable us to address some of our society's most pressing issues, such as traffic safety and pollution reduction. Transport in the future will be routed autonomously. It will not contribute to pollution in the atmosphere and will provide drivers with more comfort. There is also an infrastructure component. Vehicles and infrastructure will communicate data to reduce gridlock, improve the flexibility of crossings, and prevent accidents. There are multiple types of computer networks that provide communication between the many components of an ITS, such as information and communication technology embedded in cars and transportation infrastructure. These technologies will transform how we travel today. These programs let you share and gather essential information between vehicles and between infrastructure and vehicles to assist drivers in traveling safely and comfortably. This work aims to offer the result in real time and with a high degree of reliability for vehicle networks.

1. **Introduction :**

Traffic management and user information measures associated with "intelligent" transport systems are becoming increasingly crucial in transport policy: they are presumed to be less costly in solving congestion problems and reducing traffic consumption. Energy and the related greenhouse gas emissions; are oriented towards the user and the quality of service. As such, they facilitate an intermodal approach. They play more particularly on the reliability and safety of transport. However, the measures to manage traffic and information from users present high costs. Their cost-benefit balance deserves to be evaluated in the same way as other transport projects and policies. It is indeed desirable to compare these projects with those which preferentially play on the capacity of the networks.

Additionally, the ability to pick the most successful dynamic traffic control projects for the community is desirable. It is essential to equip decision-makers and managers with tools for evaluating ITS projects To support intelligent transport systems. All stakeholders currently recognize the lack of evaluation as an obstacle to the deployment of ITS. Governments in Europe, theUnited States,andJapanhaveinvestedheavilytoimproveintelligenttransportationsystems.Consequently, many research and development projects have been implemented to enhance the performanceofintelligenttransportationsystems.Theseprojectshavebeenparticularlysuccessfulin standardizing some communication and processing technologies assigned to intelligent transportation systems and increasing the irquality to meet the unique challenges presented by these systems.Theseprojectsalsoledtothebirthofthesmartcaranditsincreasedperformance,which combinet heability to discover the state of the environment with the ability to communicate information ninstantly. Intelligent transportation systems have relied on detectors and cameras along the road network and central monitoring stations to discover traffic. A new generation of intelligent transportation systems has emerged based on connected vehicles and V2V and V2I communications.These systems of ten referred to as VANETs, focus primarily on connected vehicles and the infrastructure connected by RSU cardand Road Side Unit. However, VANETs have many limitations ,among them: the need for a dedicated communicationsinfrastructure,lackofcentralizedmanagementoftrafficdata,anddifficulty integrating new applications and services to manage traffic (Bonnefoi, Bellotti, Schendzielorz, & Visintainer, 2007).

2. What is the ITS, and how it works?

Intelligent transport systems are the systems that allow processing, analysis, and communication of information related to transportation systems. It is called brilliant because it is based on functions related to intelligence, such as information processing, communication, memory, and adaptation to imposed conditions. In Europe, all these technologies based on intelligent transpor t systems are groupe dunder the term transport telematics. New technologies in transportation have greatly accelerated the development to fintelligent transportation systems in recent years. These systems are integrated (or in the process of integration) inall modes of transport. Vehicles, users, or infrastructure scan bee quipped withit. Its main task then is to assist in decision – making by transmission network operators and other users. These processes are often implemented in real-time, and they improve everyone's living conditions. The use of intelligent transportation systems is also part of the desire for sustainable development. Indeed, intelligent transportation systems lead to better-coordinated road use through the use of data. Therefore,the information is necessary to know the network's current state or plan its use.

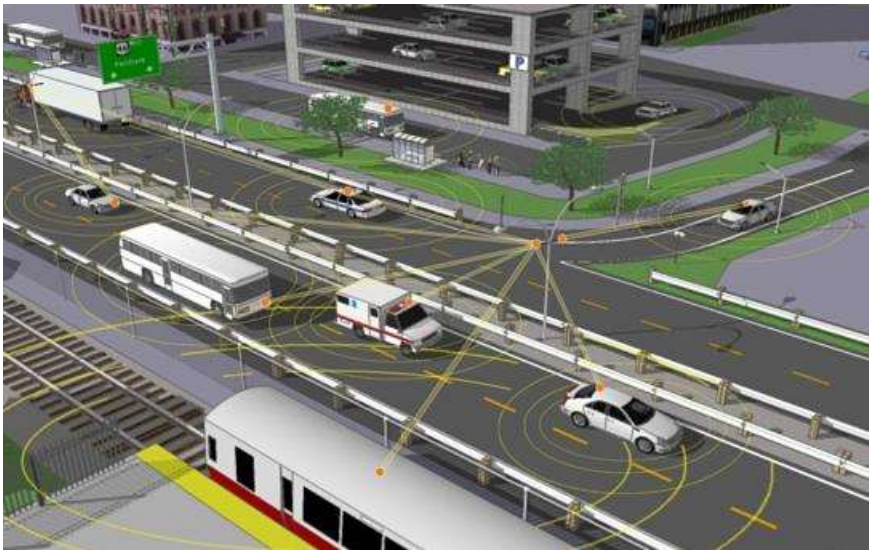

Figure 1. Applications of Intelligent Transport System

Intelligent transportation systems aim to address social issues related to transport at ion use. It is rooted in the goal of enhancing systems for consumers, drivers, and administrators. Thus, intelligent mobility networks are mainly used to control road traffic congestion and to create emerging information technology for cars.

Under this last category, we have modeling, networking networks, and real-time monitoring. Thus,

Intelligent transportation systems allow the transportation system to operate more efficiently through a variety of means. It is about saving time, lowering prices-mostly on energy consumption-and efficiency, and saving lives. World wide, intelligent transportation networks are inuse and are increasingly being improved. We often use Intelligent Transportation Systems (GPS,ADAS...) without realizing it in the transportation industry or as customers (GPS,ADAS...). The adoption of these new transportations chemesis welcomed for variousreasons,includingreducingtheriskofhumanerrorandtherebyincreasingoverall protection.Thesedevicesareubiquitousinourculture,andtheirpresenceinthefieldof transportationisonlyaverage.Forinstance,cruisecontrolandcollisiondetectionareoftenusedin modernautomobilemodels.Today,systemsthatenhancedriversafetyreferredtoas cooperativevehicleinfrastructurearestillbeingdeveloped.Theobjectiveistoincorporatetheminto futuregenerationsofcars.Anotheraimofintelligenttransportationinfrastructureistoreduce automotiveemissions.Itwillnecessitateimproved pollutioncontrolandtheuseoflow-fuelengines. However,theenvironmentalproblemisnotlimited toautomobiles.To controlair quality, infrastructurehasbeen developed. Itsobjectives are toidentify anddeteremissions andincorporatepoliciestomitigatetherisksassociatedwithair pollution.Finally,eliminatingcongestionentailssubstitutingpublictransitforprivateautomobiles. Inmajorcities,publictransitiscommonlyused.Indeed,itfacilitatestrafficmanagementand promotesenvironmentalstewardship.Therefore, it is essentialtoenhancethesemodesof transportationintermsoftraveltime,punctuality,andefficiency.Todothis,itisfascinatingto collectdatainreal-timefromavarietyofstations.There is an answer to this problem. We need to construct a fleet of wholly automated cars and provide them to the public in the same manner.

3. Technology of Cyber-cars:

Theterm"IntelligentTransportationSystems"referstoasetofinnovationsto enhancethequality ofvariousmodesoftransportationinthemodernera.Itsprogressisongoingandfast,withtheultimategoal ofcompleteautomationofinducedsystems.Thisresulthasalreadybeendesignatedandiscurrentlybeing developed:Itisforelectricautomobiles.ThedevelopmentoftheelectriccaroriginatedinEuropeinthe early1990s.In1997,theNetherlandsdevelopedthefirstelectronicvehicle-likesystemtotransport passengersviaSchipholAirport.Toputitmoreprecisely,electriccarsareroadvehiclesthatrunentirely independently ofhuman intervention and need nomaintenance.Asaresult, certain vehiclesdo notneed a pilot.People and products are to be moved along well-defined road networks via the ASDs. This traffic technology is meant to adapt to various traffic circumstances (inclementweather,gridlock,roadobstructions,etc.)(Milanés, Marouf,Pérez,González,&Nashashibi,2014).However,forautonomousvehicles,manystagesof automationcanbedefined:

Level0:Traditionalcar,withoutanautocharacter.

Level1:aidsthedriverindrivingbutdoesnotpropelhim(parkingassist,cruisecontrol,forexample).Level 2:Automationispartial,butthedrivermustalwayscontrolthedrive(thedevicewill,forexample,navigate trafficjams).

Level3:Automationissuccessfulwherepredefinedconditionsaremet.Asaresult,thedrivercanbe obligedtoreclaimmanualcontrolofhiscaronoccasion(e.g.,automatichighwaysystem).

Level4:HighAutomation,inwhichthecarrunsautonomouslyinawidevarietyofcomplexenvironments (includingurbanareas),butthedrivermustremainpresentandtechnicallycontrollable.

Level5:Automationiscomplete,andthevehiclecanrunautonomouslyunderallenvironments.Adriveris notneeded(Cui&Sabaliauskaite,2017).

Thee-carisclassified asaLevel5 vehicleunderthismetricbecauseitdoesnotneedadriver.However, in thecurrentstudy,suchvehiclesoperateonlyforparticularpurposes,suchastransportinggoods withinaspecificmetropolitanregionortransportationofgoodswithinanindustrialfield.

4. Categories of ITS:

Theworld'sroadsarecurrentlyhometomillionsofcars,andtheirnumbercontinuestogrow.Asa result,improvingtrafficquality,reducingpollution,andmitigatingtheharmcausedbycollisionshave becomeasignificantproblemincities.During the last decade, this has dramatically increased due to the implementation of intelligent transportation networks and information and communication technology. Vehiclesystemscancommunicatewithothervehiclesinan intelligenttransportationsystemthrough Vehicle-to-VehicleCommunication(V2V)orInfrastructure-to-VehicleCommunication(V2I) technologies.TherearetwoprimarycategoriesofITSapplications:protectionandreliabilityof traffic flow (A, B) (Racoceanu, 2006):

A. Road,safety,applicatios:

Roadsafetyapplicationsseektoreducetheriskofautomobilecrashesandtheharmincurredby unavoidablecollisions.Theseimplementationsneeddedicatedhardwarethatisbothreliableand timely andtimely and dependableconnections.Thesesolutionsrangefrommutualrecognition, suchasprogressmonitoring,lanedeparturealert,andspeedmanagement,toemergencyapplications, such as danger identification and adverse weather conditions.

B. Applications of Traffic Efficiency:

Theprimaryobjectiveoftrafficefficiencyistoincreasetrafficflowbyminimizingtraveltimeand congestion.Additionally,economicandenvironmentalgainscanberealized.Theseapplications provideuserswithtrafficinformation,whichistypicallybroadcastthroughinfrastructures. Managingequipmentusedtocarryhazardousmaterials. Althoughthesedemandsdonothave stringentreliabilityortimeliness,theirefficiencydegradeswithincreasingdelayand package failure (OUDJEDI DAMERDJI & REMACI, 2020).

5. Research Projects on cooperative intelligent transport systems(C-STI):

Autonomousvehicledeploymentcandependondevelopingconnectedinfrastructures:itis necessarytoensurethehomogeneityofinvestmentsinthedifferentregionstoavoidthe presenceof"whiteareas"ofmobility.Toenhancethedeploymentofautonomousvehicles,thegoal istobe aware of their environment andknowthetrafficconditionsontheroad dynamically(inreal-time)withoutrequiringhugeinvestments.C-STI, also known as cooperative intelligent transport systems (C-ITS), is an alliance of transportation systems, cars, and other infrastructure components that encourages information sharing and communication.Roadsafety,roadpersonnelsafety,trafficmanagementandimprovement,roadinformation ,andinfrastructuremanagement.TheCeremaCenterforStudiesandExperienceinRisk,Environment,Mobility,andPlanninginFrance contributes to severalresearchprojectsrelatedtointelligenttransportsystems,including:

SCOOP:aFrenchpilotprojectsupportedbytheEuropeanCommissiontodeploycollaborative intelligenttransportsystems(withoutautonomousdriving)todevelopusecasesaimedat improvingtheoperatingefficiencyofroadnetworks.Thus,boardinggearandinformationexchange within vehicles weredeployed.

IncontinuationofScoop,this collaborative ITS deployment project has enabled the coordinated development of use cases and user services on a European scale.TheC-ROADSplatformbringstogether 16 Europeancountries.

INDID:ThisFrenchresearchprojectfundedbytheEuropeanCommissionh a s launchedfouranda halfyearsago,with24partners.Itfocusesontheroleofnewtechnologiesandusescasesrelatedto autonomousvehicles,infrastructure improvement, andadvancedsecuritysolutions in particular.

FENIX:Projecttodevelopanddeployadigitalinformationsystemforlogisticaltransportalong severalEuropeancorridors.ItiscoordinatedbyERTICO,theEuropeannetworkthatbringstogether stakeholdersinIntelligentTransportSystems(ITS)andbringstogether26partnersfrom12 Europeancountries,including6 Frenchpartners.

DENSE(adverseweatherenvironmentalsensingsystem)ThisEuropeanresearchproject, implementedinpartnershipwithresearchcenters,automobilemanufacturers,equipment manufacturers,andstart-ups,aimstodevelopsensorsforintelligentvehiclescapableofoperating in severe weatherconditions.

6. The contribution of intelligent transportation to sustainable development:

Since the development of intelligent cars offers new markets and provides a wealth of economic benefits, we must point out that it has happened in the past, and we see that it'll be the case again in the future. However,wewillseethatfullautomationofvehiclescancausesometechnicalandlegalissues,especiallyfortheresponsibleagentin theevent of anaccident.

7. The contribution of intelligent transportation to economic development:

Thespreadofintelligentcarsisleadingtoachangeintheeconomicandlegalviewoftraffic.Let'sstart bydetailingthesechangesandtheirconsequencesfroma financialpointofview.Thestudiessoughttoestimatethepotentialbenefitsenvisioned in2030fromcreating and developingself-drivingcars.AccordingtothereportbyKPMG France(theFrenchauditingandaccountingfirm),theprofitwillbe51billionpoundsor70billion euros. Lackofcommunicationandsharingofinformationis oneofthecostliest factorsof all transportationsystems.ThisiswhytechnologiessuchastheV2V(VehicletoVehicle)systemare applied.Itallowsthetransmissionofinformationbetweenvehicles,especiallyabouttraffic conditionsandpotentialdisturbances.Thedirect consequencesarereducedtrafficcongestionandtraveltime,smoother traffic,reducedgasemissions, andreducedfuelconsumption. Inaddition,alloftheseresultshaveapositiveimpactonthe environment.Fromasafetypointofview,thenumberofaccidentscanbesignificantlyreduced.Humanerrorist hesourceof90%ofroadaccidents.Althoughdriverassistancesystemssuchas collisionavoidanceradarshavealreadyreducedthenumberofcasualties,thenumberoftraffic accidentvictimseachyearisstillveryhigh.AccordingtoastudybyKPMG,electroniccarscould prevent30,000hospitalizationsperyearinFranceandsave4billioneuros(Pavel,Vignolles,&Lallement,2018).Theintroductionofself-drivingvehiclesalsohasothereconomicimplications, suchasjobcreation.Indeed,itisnecessarytodevelopnewsectorsornewbusinesses.Itisabouta newmarketthatcanexpectmassiveexpansioninlightofthedemandfortheseproductsinour society.Allproduction levelsareinvolved:fromengineeringjobstoproductdevelopmentand improvement,totechniciansandcontractorstomanufacturevehicles.Wecanalsoenjoyimagining thechangesthatthefullimplementationofautonomousvehiclescouldbringtooursociety.Usingacompactcar orlargervehicleswillchangeallofourcurrenttransportation.Asurbanvehicle fleetsdevelop, thepersonalcar model disappears,at least in cities.

8. ITS CYBER-SECURITY CHALLENGES:

A.Cyber-attacksin ITS:

Theproliferationofelectroniccontrolunits(ECUs)hasintroducednewsecurityvulnerabilities. Previouslypublishedworksdemonstratedhowtocompromiseacar'sinternalnetwork,including safety-criticalcomponentssuchasthebrakesandengine.Buildersareadaptableanddo notwanttospendvastsumsofmoneyindefensewithoutareturnontheirinvestment.Recent exploitshaveshownthattheprotectionsystemsofferedbyautomobilemanufacturersare rudimentaryandinsufficient.Oneoftheprimaryreasonsfordismissingtheseattacksisthattheyare scarcecomparedtothevastnumberofunhackedvehicles.Accordingtosomeanalysts,the episodeisnotworththemoneyspentonthecars.Ontheotherhand,othersarguethathackers' motivationsarenotonlyfinancial;theycanbepoliticaloraggressiveaswell(Mohamed, Boulmakoul, & Karim, 2017).

B. Cyber security in ITS:

The following fundamental concepts denote cybersecurity specifications:

Confidentiality is the property of knowledge being protected from entities, processes,or persons.

Data integrity ensures the consistency ofdata from the point of originto theendof the destination.

Authentication is thecapability of determining if the partiesto a contractare who they appear tobe.

Availability: The property that makes knowledge available atalltimes when itis needed.

Theterm"**non-repudiation**"referstothefactthatoneofthecontractingpartiescannotdisputethe validity of his signatureon the paper (Djakboub, 2017).

9. ALegal Aspectof intelligent transportation

To be legally purchased, self-driving vehicles will need to meet stringent European legislation that mandates the driver to be in charge of the car at all times. To place internet-connected automobiles in their rightful place in traffic, we must alter the law, but we must worry about specific other difficulties. One of the first things that have to be addressed is standardization and certification. To prevent legal loopholes, differing levels of automation in cars would necessitate the development of new regulations to handle each. It will be required to verify each of these levels using other tests and criteria and the ones indicated previously. This will enable each vehicle to be allocated into a class defined by the features of the car and the other vehicle classes in the same category. How do these laws identify themselves? As the first step, it is critical to determine what is considered safe driving for electronic automobiles. As a result, self-driving automobiles are tested. Currently, it is not authorized to have vehicles on the roadway, but tests of self-driving cars are allowed. To properly ensure the safety of everyone involved, the driver must be present, accept responsibility, and assure the safety of those traveling with him. To be eligible for insurance, the firm must seek clearance from the relevant government, as these examinations occur in other countries or regions. As a result, it is strongly recommended that a code of conduct and liability for motor vehicles be put in place. In addition to rules that electronic automobiles must follow during testing, this code also includes restrictions that vehicle makers must observe. This blog contains three major components. To be qualified to operate the self-driving car, the driver must be able to manage the vehicle at all times, be aware of the potential risks, and thoroughly schooled in the new technology. If the car is in operation, we must record driving data at all times to investigate and identify whether the vehicle is powered by automated or manual driving in the case of an accident. The final step is to test the technology and car in a closed circuit to authorize its implementation on the public road. Concerns over who would be liable in the case of an accident involving electronic automobiles are far from resolved. To what insurance policies would these automobiles be subject? Is the manufacturer or the driver (passive at the time) accountable to justice if an accident results in death? What is the use of a driver's license if they are not driving? Before introducing electronic automobiles into our metropolitan areas, all of these legislative and liability difficulties must be handled.

10. Future Developments:

Thepopularizationofcybercarsisnotfortomorrow.However,manyexperimentswereconducted withautonomoussystemsinFranceandaroundtheworldundereverydayconditions.Alltestswent well,withoutincident(everytimeahumandriverwasinthecar,thefeetonthepedalswerereadyto step).So,itisnaturaltoask:Whyaren'tself-drivingcarsabouttoenterthemarket?Thegoalofthe self-drivingvehicleistoachieveawhollyautonomousandcommunicationsystem.Anditis preciselythispart,thetouch,thathasyettobedeveloped.Imaginealltheerrorsthatcan accumulatearoundcalculationsandestimatesmadeonalongjourney,becomingdisastrous. Whereashavingafullycooperatingnetworkwouldmakethetripmoreconfidentfortheuser. SomecarsdevelopedbyINDIDcandetectsigns,trafficlights,andpedestriancrossings.But whatiftherecognitionalgorithmsfailortrees or other obstacles hide the mark?Anaccident canresultfromthislackofinformation.Thisiswhymany means are currently being deployed to improve and create communication systems between vehicles (V2V) and between infrastructure and vehicles (I2V)toincreasetheamountofinformationavailableagainandagain.Imagine,for example,inacity,allcarsarecommunicatingwitheachother.Thismeansthateachvehiclewill shareitslocation,speed,anddestinationwithothers.Thiswill allowallvehiclestobettercopewiththecongestionthatallthesejourneyscangeneratetogether. Addtothistrafficlights,signs,andpedestriancrossingthatcommunicatewithcars,giving informationabouttheirconditionandtherulesthatapply(correctpriority,presenceofpedestrians, etc.).Buildingtheseinfrastructuresistherealchallengeoftomorrow.Thecreationof connectedstructuresshouldbeaSmartCitymodel,along-termsolution,andthusitshouldbeableto adapttoallprocessesof urban redevelopment(Galoul, 2015).

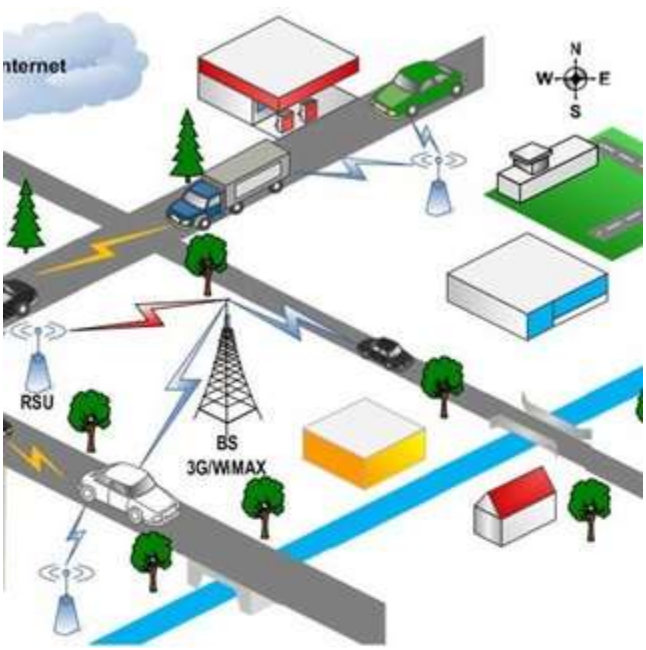

Figure2. Modeling of aV2V and I2V system

Allthiscommunication,whichisbeingdeveloped,willmakeitpossibletobridgethisinformation gap, making it possible to create safer and more adaptive transmission systems thanks to the constant flow of databeingcommunicated.As in Melbourne (2006), some communications infrastructure had already emergedwhereanentiresectionofthehighwaydetectedtraffic conditionsaswellasspeedingviolationsandsentthisinformationbacktoacentralcenterthat processedit.Butwerealizethatthiscommunicationisinsufficient. Wemustpublishthisinformation(previouslyprocessed)toallvehiclesusingthisroadwithoutbeingaffectedbyother signalsemittedbycars,mobiledevices,etc.Evenifsomeideasareraised,manytestsmustbe conducted,andhighcostsare incurred consideringthefeasibilityofsuchanexchangeof data.Thisiswhyallthese issuesrepresentthechallengesoftomorrow forallengineersand researchersworkinginthefieldofintelligenttransportsystems,telecommunications,anddata transmission.Whileawaitingthedevelopmentandgeneralizationofthesecommunication infrastructures,thesearchforautonomouscarscontinuestoprovideaparticularservicewithoutleaving anychoice tochance.

Conclusions:

Intheconclusionofourstudyofsustainabledevelopmentofintelligenttransportation,we concludethatsmarttransportationworkstoachieveseveraleconomic,social,andenvironmental goals.Itwillresultinfeweraccidentsandlessseverity,andlesstrafficcongestion.Italsoimproves and encourages public transport services, reduces pollution resulting from emissions left by vehicles, and grantslargemarginsforsafetyandsecurityutilizingvehiclecontrolandsafety systems.Itwillleadtocontrolling spendingonroadconstructionand maintenance. Inaddition,information systems help road usersreducelosttimeincongestion,thusgainingmorecontroland controllingvehiclesandreducingaccidentsresultingfromthecar,humanfactor,orthe environment.Despite their relevance in numerous modes of transportation, these systems are not included in the future projects on which scientific study is focused.

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