IEEE ITS COUNCIL NEWSLETTER

Editor: Prof. Alberto Broggi, broggi@ce.unipr.it

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Contributors to This Issue

Daniel. J. Dailey, Charles J. Herget, Gerd Krämer, Sam Kwong,
Michel Parent, Chelsea C. White, Jerri White

ITS Council Executive Committee

President: ............... Daniel J. Dailey
d.daily@ieee.org
Vice President Conferences: H. Hashimoto
h.hashimoto@ieee.org
Vice President Finance: ..Emily Sopensky
e.sopensky@ieee.org
Vice President Publications: . Yi Lin Zhao
y.zhao@ieee.org
Secretary: .................Charles J. Herget
c.herget@ieee.org
Immediate Past President: "Umit "Ozg"uner
u.ozguner@ieee.org
Transactions Editor: .... Chelsea C. White
c.white@ieee.org
Newsletter Editor: .........Alberto Broggi
a.broggi@ieee.org
World Congress Liaison: Chelsea C. White
   c.white@ieee.org

Information for contributors

Announcements, feature articles, books and meetings reviews, opinions, letters

to the editor, professional activities, abstracts of reports, and other material
of interest to the ITS community is solicited.

Please submit electronic material for consideration in any of the following for-

mats: BTeX, plain ASCII, or Word, to the Editor at broggi@ce.unipr.it at
at least 1 month prior to the newsletter's distribution:

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From the Editor

by Alberto Broggi

Dear ITS-researcher,

This issue of the Newsletter is mainly focused on our conferences ITS Conference and IV Symposium. You will find the call for participation and call for papers of the 2001 and 2002 events. This will allow us a better scheduling of our activities, in order to meet the submission deadlines.

I encourage you to contact me via e-mail at broggi@ce.unipr.it regarding ideas and suggestions on how to improve our Newsletter, the main IEEE sponsored means of communication among ITS researchers.

Thanks again to everyone for helping me completing this issue.

Calendar of Council Events

by Charles J. Herget

Next Meetings are scheduled as follows:

**ITS Council Meetings:**

- August 26, 2001 ............... Oakland, California, during IEEE ITS Conference 2001

**ITS Executive Committee Meetings:**

- July 7, 2001 ................................. teleconference
- August 26, 2001 ............... Oakland, California, during IEEE ITS Conference 2001
- November 17, 2001 ......................... Mexico City, Mexico

**ITS Council Committee Meetings:**

- August 25, 2001 ............... Oakland, California, during IEEE ITS Conference 2001
Envisioning a Radar-Based Automatic Road Transportation System

by Gerd Krämer

Current technology makes possible the design of a fully automatic road transportation system. Such a system can be affordable and can be implemented progressively in combination with present driver-controlled traffic. This article presents a proposal for such a system’s architecture.

Requirements

Merely scheduling vehicles on designated tracks is insufficient; an automatic road transportation system must also consider noncooperative road users (drivers, bicyclists, and so on who are not part of the automatic system) and random obstacles. So, the system has these requirements:

- It must provide automatic guidance for cooperative vehicles based on user commands for destination, preferred route, mode, priority, and so on while considering the local and global traffic situation.
- It must detect and monitor noncooperative road users and random obstacles and consider them when generating guidance commands.
- It must register and consider road conditions and traction parameters for individual vehicles.
- It should guarantee optimum traffic flow with respect to road congestion, noise, fuel consumption, and so on.
- It should provide advantages obtainable only with full automation—for example, unmanned transportation of goods, and driverless vehicle movement to parking facilities.

The basic architecture

Figure 1 depicts a system that would fulfill these requirements. It has three major components:

- A network of short-range, high-resolution radar sensors that monitors traffic space. Such surveillance covers all fixed and moving objects in a relevant area by measuring their location, size, and velocity.
vector. Radar provides all-weather capability and allows 24-hour operation. Equipment inside the autonomous vehicles could supplement these sensors, as I describe later.

- A network of sensors, some in the vehicles, that registers road conditions and traction parameters.
- A computer network that performs central guidance. It receives information from the two sensor systems and the road users and generates guidance commands.

Different types of roads require different system architectures and operation modes:

- On rural high-speed roads, the system must consider obstacles intruding into areas adjacent to the roads—for example, animals approaching the lanes.
- Pedestrian sidewalks must be blocked off by a fence, if the speed allowed for vehicles is much faster than walking speed, because the automatic system cannot anticipate a sudden intrusion of a pedestrian into the lane.
- In living areas, parking lots, and so on, vehicles must operate at a very low speed. The local guidance system might communicate with road users by indicating its intentions through visible and audible signals. It also might communicate with pedestrians acoustically and accept requests from pedestrians— for example, from terminals provided at the roadside.

Traffic space surveillance

The network of radar sensors guarantees low-power operation and flexibility in case of road expansions. The sensors have these requirements:

- They must detect all targets on the roads and in neighboring safety zones.
- The radar spatial-resolution cell should be a cube approximately 20 centimeters wide. This will allow localization of detected obstacles with accuracies on the order of 20 cm, which seems adequate for road vehicle guidance.
- The sensors should unambiguously measure radial velocities between -150 and +150 meters per second. This velocity interval is larger than that of present road vehicles and includes the velocities of high-speed trains, so it seems adequate for a future system.
- To guarantee the detection of any relevant obstacle within 10 milliseconds, the sensors must detect a target with a radar cross-section of $1.96 \times 10^{-3}$ square meter (−27 decibel-square-meter), corresponding to a metal sphere of 5 cm diameter in the optical region, after 10 ms of coherent processing time. Such sensors likely will detect objects with larger radar cross-sections in shorter times. Because a vehicle at maximum velocity moves only 1.5 m in 10 ms, this maximum processing time seems reasonable.
- The sensors should minimize shadow areas behind targets, to avoid obscuration of other important targets.
- Radar signals should also be able to serve for precision navigation.

To minimize shadow areas, the radar sensors should be at elevated positions—for instance, at the tops of poles located alternately on both sides of the road (see Figure 2). A combination of different sensor networks is also conceivable. For example, a network of densely spaced sensors on poles of lower height, with detection times on the order of 100 ms, would monitor road surface obstacles. A network of more widely spaced sensors on higher poles, with lower spatial resolution but coherent integration times of 10 ms or less, would monitor vehicles. Because a radar sensor’s maximum observation range is only a few dekameters, even at very high radar frequencies atmospheric attenuation is small. The targets to be detected might be only a few centimeters in size, so I propose the use of millimeter-wave radar, which also means small antenna dimensions. Kamal Sarabandy, Eric Li, and Adib Nashashibi have investigated the radar backscatter of road surfaces at millimeter-wave frequencies [1]. I have also considered high-resolution radar operating with Lüke-Schotten codes fulfilling the above requirements; the radar’s frequency is 200 GHz, corresponding to a wavelength of 1.5 mm [2,3]. The necessary radar transmitter power is on the order of 2 milliwatts, far below any hazardous limits.
Precision navigation

The radar signals should be such that the cooperative vehicles could determine their own location and velocity vectors, with accuracies on the order of 20 cm or less for their locations and 0.5 meters per second or less for their velocities. These figures seem to be reasonable for vehicles with dimensions on the order of meters and velocities up to 150 meters per second. Using interferometric antenna arrangements, the vehicles might also determine their turn rates from the signals. As an alternative to designing radar signals such that they also serve for vehicle navigation, the system could transmit special navigation signals in addition to the radar signals. The processing of the signals is similar to that in a Global Positioning System; the only difference is that the required navigation accuracy for automatically guided road vehicles is much higher than that for aircraft.

Secondary radar concepts

The in-vehicle precision navigation system might also transmit the vehicle’s position, velocities, turn rates, and so on to the central guidance system. This would substantially reduce the tasks for the fixed-installation radars, which would then only detect and observe noncooperative road users and random obstacles. Also, noncooperative road users and pedestrians might carry responders that communicate with the central guidance system. Because of the low signal powers involved, the responders could even be integrated in wristwatches.

Progressive system implementation

During the conversion to an exclusively automatic road transportation system, vehicles with drivers might have transceivers that communicate with the central guidance system. The reception of guidance information would allow for participation in optimum traffic management. The realization of the automatic transportation system should start with a small prototype to successively refine the definition of sensor requirements and the algorithms for the central guidance system. Simultaneously, there should be development of detailed computer simulation models for the system components and the complete system, to extensively study the system’s behavior well before final implementation.

The proposed radar frequency is at the upper limit of available transistors, although researchers have worked on semiconductor amplifiers even in the 350-GHz region. The necessity of large numbers of identical radar sensors in the proposed system, however, would justify the development of a sophisticated radar sensor with the required parameters. Although today’s technology enables the realization of the central guidance system as a network of computers, researchers have not yet developed any basic concepts or algorithms. This is also true for sensor systems for registering road conditions and traction parameters. However, the
tremendous gain in efficiency and safety from an automatic road transportation system should provide stimulus for such research.

References


Report on ITS Council meeting

by Charles J. Herget

The Executive Committee (ExCom) of the Council consists of the President, the Past President, the Vice Presidents for Finance, Publications, and Conferences, the Transactions Editor, the Newsletter Editor, and the Secretary. The ExCom meets several times per year in addition to the regular meetings of the Administrative Committee (AdCom). The purpose of these meetings is to review the status of the Council’s activities.

The topics covered usually include the budget, the conferences, and the publications.


The upcoming Conferences which were discussed included ITSC 2001 in Oakland, California, IV 2002 in Versailles, France, ITSC 2002 in Singapore, IV 2003 in Columbus, Ohio (tentative), ITSC 2003 in Shanghai, China, ITSC 2004 in Northern Virginia (tentative), and IV 2004 in Parma, Italy (tentative).

Discussion on the Transactions focused on preparation for the review by IEEE in 2002. During discussion on the Newsletter, the ExCom supported the inclusion of advertising.
Call For Participation: The IEEE 4th International Conference on Intelligent Transportation Systems

by Daniel J. Dailey

Dear Colleague,

I would like to invite you to join us at the 4th International IEEE Conference on Intelligent Transportation Systems (ITSC).


It will be held in the San Francisco Bay area in Oakland, CA, USA, on August 25-29, 2001.

ITSC'01 is the premier technical conference on ITS and will be an international forum that brings together professionals from the fields of transportation, automotive technology, and information technology.

The countries represented include: Austria, Canada, Czech Republic, Egypt, Finland, France, Germany, Greece, Hong Kong SAR, India, Israel, Italy, Japan, Korea, Mexico, Morocco, Netherlands, P. R. China, Poland, Portugal, Singapore, Spain, Sweden, UK, Taiwan R.O.C., USA, Ukraine, and Uruguay

The ITSC'01 program includes 60 sessions of peer-reviewed technical papers and invited panels as well as exhibits featuring Information Technology in Intelligent Transportation Systems.

The preliminary program can be found at:


Conference Registration information is available at:


Hotel reservation information is available at:


Hope to see you in the San Francisco Bay Area in August!!

Daniel J. Dailey
dan@ee.washington.edu

ITSC 2001 Program Chair
Associate Professor
Department of Electrical Engineering
University of Washington
Seattle, WA 98195
Call For Papers: 2002 IEEE Intelligent Vehicles Symposium

by Michel Parent

The next conference IV 2002 (Intelligent Vehicles) will be in Versailles on June 18-20, 2002. The event will take place next to the palace in a comfortable conference center close to local hotels and within walking distance to train stations for quick connections to Paris.

This important event will happen in close cooperation with prestigious French research organisations and industries which are located nearby: INRETS, LCPC, Renault, Peugeot-Citroen, Ford, DaimlerChrysler, Thales, Matra, Valeo, Cofiroute, ... and INRIA which is the organiser of the conference. All these organisations will provide visits after the conference together with live demonstrations at the conference site and on the test tracks of the LIVIC which is in Versailles nearby.

The organisers invite you to present your communications before December 1, 2001 through electronic means at http://www.inria.fr/iv2002.

———

IEEE Intelligent Vehicle Symposium

Versailles, France, June 18-20, 2002

CALL FOR PAPERS – The IEEE Intelligent Transportation System Council (ITSC) and the Institut National de Recherche en Informatique et en Automatique (INRIA) are sponsoring a professional-level conference on basic research on present and future applications for Intelligent Vehicles and Intelligent Infrastructures. Papers dealing with vehicle-related intelligent systems are solicited. This symposium is characterized by a single session format so that all the attendees remain in a single room for multilateral communications in an informal atmosphere. As another tradition, the meetings have enthusiastic participation from industry, as well as research centers and universities.

TOPICS

• Driver Assistance Systems
• System Architectures
• Sensors
• Navigation/Guidance Systems
• Imaging and Vision Enhancement
• Vehicle Control
• Maneuvers Planning and Decision
• Human-machine Interfaces
• Active Safety
• Special Automated Road Vehicles
• Communications and Networks
• AHS

Contributions to the following topics are particularly welcome:

*Vision in Adverse Weather Conditions, Night Vision, Pedestrian Recognition and Stop&Go Driving.*

**PAPER SUBMISSION**

Submission and evaluation of papers will be done exclusively through electronic means. Prospective authors are requested to send an electronic version of their draft paper (pdf or Word format, 10 pages maximum, A4 or letter size) and a 1 page abstract no later than **December 1st, 2001.**

Submission procedure will be available at: [http://www.inria.fr/iv2002](http://www.inria.fr/iv2002)

**TUTORIALS and DEMOS**

Tutorial sessions will be held on June 17 (Monday) at INRIA, located just outside of Versailles. Tutorials are planned on high precision GPS and Navigation, Robust Image Analysis for Intelligent Vehicles and on Vehicle Control.

A special demonstration day will be held on June 21 (Friday). Various demonstrations are planned in the neighborhood of Versailles and in particular at the Livic, at INRIA, at Renault and PSA and also at the conference site.

Contributions, in particular vehicle demonstrations, are highly welcome. Please contact the Demos Chair, Jean-Marc Blosseville (blosseville@inrets.fr).

**DEADLINES**

- Draft paper due for review ................. December 1st, 2001
- Notification of acceptance .................... March 1st, 2002
- Camera-ready copy for proceedings due ........ April 1st, 2002

**UP-TO-DATE INFORMATION**

Please refer frequently to the above mentioned website for the most up-to-date information or contact the General Chair ([Michel.Parent@inria.fr](mailto:Michel.Parent@inria.fr)) or the Program Chair ([uwe.franke@daimlerchrysler.com](mailto:uwe.franke@daimlerchrysler.com)) or [symposia@inria.fr](mailto:symposia@inria.fr).
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The IEEE 5th International Conference on Intelligent Transportation Systems
Singapore, September 3-6, 2002
www.ieee.org/itsc/2002

The IEEE Intelligent Transportation Systems Council (ITSC) is sponsoring a conference on basic research and applications of leading advances in communications, computers, control, and related electronics technologies related to Intelligent Transportation Systems (ITS).

PROGRAM TOPICS

- Sensors (infrastructure & vehicle-based)
- Communications (side area & vehicle-to-roadside)
- Simulation (continuous, discrete, real-time)
- Human-Computer Interfaces (displays, artificial speech)
- Control (adaptive, fuzzy, cooperative neuro)
- Decision Systems (expert systems, intelligent agents)
- Systems (engineering, architecture, evaluation)
- Information Systems (databases, data fusion, security)
- Computers (hardware, software)
- Technology Forecasting & Transfer
- System/Subsystem Electromagnetic Compatibility
- Signal Processing
- Reliability & Quality Assurance
- Imaging & Image Analysis
- Vehicle Control
- Standards
- Traffic Theory in ITS
- Routing & Route Guidance
- Transit Applications
- Air Traffic Control
- Navigation & Guidance System
- Port and terminal automation

Proposals for special sessions and suggestions for tutorials are invited and should be forwarded to dhl@nus.edu.sg.

PAPER SUBMISSION

Complete manuscripts in PDF format must be electronically submitted for review no later than March 1, 2002 at the following address:

www.itvs.eng.nus.edu.sg/itsc2002

Submitted manuscripts must be no longer than six (6) pages in IEEE two-column format, including figures, tables, and references. A LaTeX style file and a Microsoft Word template are available from the IEEE web site (www.ieee.org/organizations/pubs/authors.html). HOWEVER, submissions MUST be in PDF format.

In addition to the manuscript, a cover page should be sent that includes: (1) the title of the paper, (2) the name(s) of the author(s), (3) the technical categories, and (4) the name, mailing address, telephone and fax numbers, and email address of the corresponding author. Notification of acceptance is scheduled for May 15, 2002.

IMPORTANT DATES

- Paper submission deadline................................. March 1, 2002
- Notification of acceptance................................. May 15, 2002
- Camera-ready copy due................................. July 1, 2002
Report on IEEE Trans. on Intelligent Transportation Systems

by Chelsea C. White

IEEE Transactions on Intelligent Transportation Systems

Editor’s Report, Revised 18 July 2001

We have published two issues in 2001 thus far,. Vol. 2, No.2, June 2001 is the Special Issue on Automatic Air Traffic Control, Part II, guest edited by N. Harris McClamroch and Banavar Shridhar. We are now working on Vol. 2, No. 3, September 2001. We have already sent in 3 final manuscripts to the IEEE for the September issue and expect at least one more soon. Therefore, we do not have a table of contents ready at this time.

Since the Transactions began receiving papers, we have received a total of 138 papers to date. This figure does not include papers which were submitted for special issues but were not accepted for publication. We currently have 7 accepted papers which have not been completed and returned in final manuscript form.

We currently several special issues planned for future issues. I am asking for updates from the guest editors. They are as follows:

Prof. Ryuji Kohno is proceeding with a special issue on Communications Technology for ITS. He will be considering from 5 to 10 papers for this issue. He has also proposed a second special issue on Communications Technology containing the best papers presented at IV2001.

Prof. Katsushi Ikeuchi has also proposed a special issue of papers presented at IV 2001 in the area of Intelligent Control and Sensing in IV. He plans an issue of 5-6 papers with a 50page-budget. Work is proceeding on this special issue.

Professors Alberto Broggi and Petros Ioannou report that they have identified 11 papers for consideration for a special issue composed of the best papers presented at ITSC and IV 2000. We hope to publish this issue in December 2001 or March 2002.

Prof. Angela Di Febbraro of DAUI - Politecnico di Torino has submitted a proposal for a special issue on the "Discrete Event Systems in Transportation."

Prof. Shoichi Washino would like to propose a special issue from the ITS World Congress but at present the page budget is a limitation. Our page budget will increase to 360 pages in 2002. The page budgets will be increased gradually over the coming years.
CFP: IEEE Transactions on Intelligent Transportation Systems
by Chelsea C. White

IEEE Transactions on Intelligent Transportation Systems

Call for Papers

The IEEE Intelligent Transportation Systems Council (ITSC) announces a new transactions journal, the IEEE Transactions on Intelligent Transportation Systems.

Improved planning, design, management, and control of future transportation systems requires conducting both basic and applied research to expand the knowledge base on transportation. The new IEEE Transactions on ITS will focus on the design, analysis, and control of information technology as it is applied to transportation systems. Topics to be considered will include, but will not be limited to:

- Sensors (infrastructure & vehicle-based)
- Communications (wide area & vehicle-to-roadside)
- Man-Machine Interfaces (displays, artificial speech)
- Decision Systems (expert systems, intelligent agents)
- Simulation (continuous, discrete, real-time)
- Reliability & Quality Assurance
- Imaging and Image Analysis
- Information Systems (databases, data fusion, security)
- Computers (hardware, software)
- Control (adaptive, fuzzy, cooperative, neuro, large systems)
- Technology Forecasting & Transfer
- Systems (engineering, architecture, evaluation)
- Signal Processing
- Standards.

Transportation systems are usually large-scale in nature and are invariably geographically distributed. The complexity of transportation systems arises from many sources. Transportation systems can involve humans, vehicles, shipments, information technology, and the physical infrastructure—all interacting in complex ways. Many aspects of transportation systems are uncertain, dynamic and nonlinear, and such systems may be highly sensitive to perturbations. Controls can involve multiple agents that are distributed and hierarchical. Personnel who invariably play critical roles in a transportation system have a diversity of objectives and a wide range of skills and education.

Despite such complexity, the emergence of new technologies—such as sensors, communications, low-cost, faster computation, and new control and optimization algorithms—provides new opportunities to substantially improve efficiency, safety and environmental impact. With the use of these technologies, new and faster measurements are possible and more data can be managed and processed. Additionally, new strategies for management and control will be developed to deal with both the static and the dynamic nature of transportation systems. So, while most of the classical transportation problems raised in the past continue to exist, there now are new approaches with which to contend.
The intent of the IEEE Transactions on ITS will be to serve as a forum for the technological aspects of information technology to transportation, thus providing researchers with an outlet for publication.

For further publication guidelines, contact the editor at ccwiii@umich.edu or by call 734-764-5723. Please send five (5) copies of your manuscript for possible publication to:

Chelsea C. White, III, Editor
Department of Industrial and Operations Engineering, College of Engineering
University of Michigan
Ann Arbor, Michigan 48109-2117 USA
CFP: Special Issue on Soft Computing Techniques in Intelligent Vehicle Systems

by Sam Kwong

Call for Papers
IEEE Transactions on Industrial Electronics
Special Issue on
Soft Computing Techniques in Intelligent Vehicle Systems

Scope

The information age we are embracing is imposing great challenges to the Intelligent Vehicle Systems (IVS). Modern car drivers expect to be able to drive safely while exchanging information with the outside world. Vehicle safety technologies, such as collision warning, driver assistance and autonomous driving, as well as injury reduction in case of an accident are the basic concerns of intelligent vehicle systems. Information and connectivity is another essential aspect. Intelligent vehicle systems are supposed to be able to provide filtered information about local traffic conditions, navigation, and weather conditions and provide useful suggestions. With the help of Internet and telecommunication technologies, drivers can check emails, browsing Internet and even handle business without stepping out of the car. To meet the increasing demand for safety and connectivity, intelligent vehicle systems need to have stronger capability of understanding the environment, learning from the history, and making correct decisions with uncertain, partial or imprecise information.

Soft Computing is an emerging field that consisting of complementary elements of Fuzzy Logic, Neural Computing, Evolutionary Computation, Machine Learning and Probabilistic Reasoning. Due to their strong learning and cognitive ability and good tolerance of uncertainty and imprecision, Soft Computing techniques have found wide applications in Intelligent Vehicle Systems. This Special Issue will be dedicated to the publication of the latest advancements in theory and application of Soft Computing techniques to intelligent vehicle systems. Topics may include but are not limited to:

- Adaptive Cruise Control
- Collision Avoidance and Obstacle Detection
- Driver Behavior Modeling and Monitoring
- Lane Detection and Tracking
- Optimization of Vehicle Safety Equipments
- In-Vehicle Navigation and Communication
Submission

Four hard copies of each submitted paper should be sent to one of the Guest Editors for the author's region at the addresses below. Electronic submissions in postscript or pdf format are encouraged. Submitted papers should be in the IEEE TIE format with a title page including a complete mailing address for each author plus an abstract of the paper. Please also email a copy of the title page in plain text to one of the Guest Editors. More information on style guidelines for a submission can be obtained at the IEEE Transactions on Industrial Electronics's Website: http://www.trans-ie.uni-wuppertal.de

Submission deadline ...................... 31 August 2001
Notification of acceptance .................. 31 October 2001
Expected date of publication ................. to be decided

Guest Editors

Sam Kwong  
Department of Computer Science  
City University of Hong Kong  
83 Tatchee Avenue  
Kowloon, Hong Kong  
China  
Email: cssamk@cityu.edu.hk

Yaochu Jin  
Future Technology Research  
Honda R&D Europe (D) GmbH  
Carl-Legien-Strasse 30  
63073 Offenbach/Main  
Germany  
Email: yaochu.jin@hre-ftr.rd.honda.co.jp
CFP: IEEE Intelligent Systems Magazine
by Alberto Broggi

IEEE Intelligent Systems Magazine
Call for Short Papers/Reports

IEEE Intelligent Systems Magazine has started a regular department on Intelligent Transportation Systems. This department (published in each issue) describes current trends and ideas for future systems/realizations/projects in the field of ITS.

People willing to share their ideas and disseminate the results of their projects are invited to prepare a short article (from 2 to 5 magazine pages) describing current trends, projects, research directions, and their experience in any field of Intelligent Transportation Systems.

For further publication guidelines and for suggestions, contact the editor at broggi@ce.unipr.it with a possible outline of the proposed article.

Thanks to an agreement with the Magazine, published articles are reprinted in this Newsletter.