An Integrated Embedded System Architecture for In-Vehicle Telematics and Infotainment System

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Abstract—In this study, an integrated embedded system architecture for in-vehicle telematics and infotainment system (IVTIS) is proposed. A wireless communication network is utilized to provide the location-based and emergency services to the in-vehicle users, while the in-vehicle network is established to provide applications in communications and entertainment. The prototype of the system is demonstrated as well.

I. INTRODUCTION

Traditional on-board embedded electronics systems that performing various operational functions, such as anti-lock brake, cruise control, climate control, etc... are already utilized in most of today's modern vehicle [1, 2]. Recent trend shows that more and more in-vehicle embedded system are focusing on providing better functionalities, robust operation and higher degree of convenience to the in-vehicle users. Advance of wireless communication and information technology in the digital era has promoted new killer applications to the in-vehicle drivers and occupants. Among these advanced killer applications, services provided in the area of the telematics and information/entertainment have attracted most attention in the automotive industry.

A. Telematics Service

Telematics were considered as the system that provides location-based services for mobile vehicles over wireless communication networks. Typical example of automotive telematics services are emergency call (or *mayday*) systems, which instantly connects vehicle users to a service center for emergency assistance or roadside services while automatically reporting the vehicle's position [3]. Normally the emergency call system requires a wireless transceiver for voice and data communication and an on-board GPS (Global Positioning System) receiver for positioning. Telematics system was considered as the core technology in an Intelligent Transportation System (ITS) and applications of telematics services to ITS have been proposed recently. An integrated positioning system were developed to realize an efficient and cost-effective GPS based electronic road pricing system by He, Law, and Ling [4]. In [5], the importance of "situational awareness" in conveying the state of the automobile to other parties across a communication link was addressed and a novel

interactivity environment for integrated intelligent transportation and telematic systems was proposed.

B. Information/Entertainment Services

As more and more people are traveling with Internet-enabled information appliances (IA) such as notebook PCs, PDAs, mobile phones, digital cameras, MP3 players, etc...., there is a desire to connect to the Internet permanently from anywhere, at anytime, without any disruption of service, particularly for those people who spend a significant amount of time in mass transportation systems on weekdays or in their own vehicle during weekend [6]. In order to access the Internet, an in-vehicle local area network or personal area network environment must be established, and the in-vehicle embedded system shall become the mobile gateway for these Internet-enabled IA. Ernst, Uehara, and Mitsuya [6], detailed the networking requirements for connecting vehicles to the Internet by displacing an entire IPv6 network and network mobility support in the InternetCAR project. In [7], the software and hardware requirements in designing human-computer interface for an in-vehicle information system were proposed such that the safety of the in-vehicle drivers is discussed. A distributed service-based architecture [8], based on the Jini middleware technology, were proposed to provide fault tolerant application services to remote in-vehicle computers and mobile devices, such as Wifi-enabled PDA and GPRS phone. It seems that research trend has shifted to providing an *infotainment server* system for the in-vehicle users such that the network-enabled IA can access the information from the in-vehicle network and also obtain the entertainment services from the entertainment server.

An integrated architecture for in-vehicle telematics and infotainment system (IVTIS) can provide the in-vehicle users value-added services compared with traditional telematics only systems. Thus, an in-vehicle telematics and infotainment system utilizing embedded system with power embedded operation system is proposed in this paper. The packet radio network was adopted to provide the telematics service to the in-vehicle users. And an in-vehicle network environment is established such that a client/server type of in-vehicle infotainment system can be developed. The detailed design and development of the IVTIS will be described as below.

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the Internet of Everything provides links not only among things but also data people and business processes The evolution of current sensor and device networks with strong interactions between people and social environments will have a dramatic impact on everything from city planning first responders the military and health Such a shared ecosystem will allow for the interaction between data sensor inputs and heterogeneous systems Semantics is a fundamental component of this since semantic technologies are able to provide the necessary bridge between different data representations and to solve terminology incongruence Integrating data from distributed devices sensor networks social networks and biomedical instruments requires first of all the systematization of the current state of the art in such fields Then it is necessary to identify a common action thread to actually merge and homogenize standards and techniques applied in such a heterogeneous field The exact requirements of an Internet of Everything environment need to be precisely identified and formally expressed and finally the role of modern computing paradigms such as Cloud and Fog Computing needs to be assessed with respect to the requirements expressed by an Internet of Everything ecosystem   Cyber Physical Systems Anupam Baliyan,Kuldeep Singh Kaswan,Naresh Kumar,Kamal Upreti,Ramani Kannan,2023-01-11 Cyber Physical System CPS is an integration of computation networking and physical processes the combination of several systems ofdifferent nature whose main purpose is tocontrol a physical process and through feedback adapt itself to new conditions in real time Cyber Physical System Concepts and Applications includes an in depth coverage of the latestmodels and theories that unify perspectives It expresses the interacting dynamics of the computational and physical components of asystem in a dynamic environment Covers automatic application of software countermeasures against physical attacks and impact of cyber physical system on industry 4 0 Explains how formal models provide mathematical abstractions to manage the complexity of a system design Offers a rigorous and comprehensive introduction to the principles of design specification modelling and analysis of cyber physicalsystems Discusses the multiple domains where Cyber Physical system has a vital impact and provides knowledge about different models thatprovide mathematical abstractions tomanage the complexity of a system design Provides the rapidly expanding field of cyber physical systems with a Long needed foundational text by an established authority This book is primarily aimed at advanced undergraduates graduates of computer science Engineers will also find this book useful   Cyber-Physical Systems: Architecture, Security and Application Song Guo,Deze Zeng,2018-09-20 This book provides an overview of recent innovations and achievements in the broad areas of cyber physical systems CPS including architecture networking systems applications security and privacy The book discusses various new CPS technologies from diverse aspects to enable higher level of innovation towards intelligent life The book provides insight to the future integration coordination and interaction between the physical world the information world and human beings The book features contributions from renowned researchers and engineers who discuss key issues from various perspectives presenting opinions and recent CPS related achievements Investigates how to advance the development of cyber physical

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offering insights into reliability issues in digital design and their cross layer countermeasures <u>Advances in Computational Intelligence and Communication</u> Manolo Dulva Hina,Amar Ramdane-Cherif,Rafik Zitouni,Assia Soukane,2022-12-13 This book presents select papers from the 2nd EAI International Conference on Computational Intelligence and Communications CICom 2021 The papers reveal recent advances in the broader domains of Computational Intelligence including 1 automation control and intelligent transportation system 2 big data Internet of Things and smart cities 3 wireless communication systems and cyber security and 4 human brain computer interfaces and image and pattern recognition The book demonstrates complex real world problems in which mathematical or traditional modelling are not the preferred solution and posits alternative solutions This collection of applications demonstrates the important advances in computational intelligence The chapters present various ideas that will benefit researchers graduate students and engineers in this domain **CAD for Hardware Security** Farimah Farahmandi,M. Sazadur Rahman,Sree Ranjani Rajendran,Mark Tehranipoor,2023-05-11 This book provides an overview of current hardware security problems and highlights how these issues can be efficiently addressed using computer aided design CAD tools Authors are from CAD developers IP developers SOC designers as well as SoC verification experts Readers will gain a comprehensive understanding of SoC security vulnerabilities and how to overcome them through an efficient combination of proactive countermeasures and a wide variety of CAD solutions

Information Technology - New Generations Shahram Latifi,2017-07-15 This volume presents a collection of peer reviewed scientific articles from the 14th International Conference on Information Technology New Generations held at the University of Nevada at Las Vegas on April 10 12 at Tuscany Suites Hotel in Las Vegas The Book of Chapters addresses critical areas of information technology including web technology communications computing architectures software engineering security and data mining *Proceedings of IAC-EIaT 2014* collective of authors,2014-12-02 Conference proceedings International Academic Conference on Engineering Internet and Technology in Prague 2014 IAC EIaT 2014 in Prague Friday Saturday December 12 13 2014 *Hardware Security* Mark Tehranipoor,Kimia Zamiri Azar,Navid Asadizanjani,Fahim Rahman,Hadi Mardani Kamali,Farimah Farahmandi,2024-06-11 This book provides a look into the future of hardware and microelectronics security with an emphasis on potential directions in security aware design security verification and validation building trusted execution environments and physical assurance The book emphasizes some critical questions that must be answered in the domain of hardware and microelectronics security in the next 5 10 years i The notion of security must be migrated from IP level to system level ii What would be the future of IP and IC protection against emerging threats iii How security solutions could be migrated expanded from SoC level to SiP level iv the advances in power side channel analysis with emphasis on post quantum cryptography algorithms v how to enable digital twin for secure semiconductor lifecycle management and vi how physical assurance will look like with considerations of emerging technologies The main aim of this book is to serve as a comprehensive and concise roadmap for new learners and educators

navigating the evolving research directions in the domain of hardware and microelectronic securities Overall throughout 11 chapters the book provides numerous frameworks countermeasures security evaluations and roadmaps for the future of hardware security **Emerging Innovations in Agile Software Development** Ghani, Imran,2016-01-26 Agile is a relatively recent methodology used in the development process of a project Therefore it is important to share new emerging knowledge with researchers and professionals interested in adopting an agile mindset Emerging Innovations in Agile Software Development focuses on the use of agile methodologies to manage design develop test and maintain software projects Emphasizing research based solutions for contemporary software development this publication is designed for use by software developers researchers and graduate level students in software engineering and project management programs

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