Online Library Intelligent Unmanned Ground Vehicles Autonomous Navigation Research At Carnegie Mellon The Springer International Series In Engineering And Computer Science Pdf Free Copy

Robotics Research Dec 12 2021 This volume presents a collection of papers presented at the 14th International Symposium of Robotic Research (ISRR). ISRR is the biennial meeting of the International Foundation of Robotic Research (IFRR) and its 14th edition took place in Lucerne, Switzerland, from August 31st to September 3rd, 2009. As for the previous symposia, ISRR 2009 followed up on the successful concept of a mixture of invited contributions and open submissions. Half of the 48 presentations were therefore invited contributions from outstanding researchers selected by the IFRR officers, and half were chosen among the 66 submissions after peer review. This selection process resulted in a truly excellent technical program which, we believe, featured some of the very best of robotic research. Out of the 48 presentations, the 42 papers which were finally submitted for publication are organized in 8 sections that encompass the major research orientations in robotics: Navigation, Control & Planning, Human-Robot Interaction, Manipulation and Humanoids, Learning, Mapping, Multi-Robot Systems, and Micro-Robotics. They represent an excellent snapshot of cutting-edge research in robotics and outline future directions.
A Real Time Operating System Based Test-bed for Autonomous Vehicle Navigation Aug 08 2021 "Research and experiments on ... Autonomous Navigation Schemes and Algorithms need an efficient test-bed for objective performance analysis. These algorithms often require sensor inputs from the systems such as the speed and steering sensors to apply feedback control action. An efficient test-bed provides status of all sensors and records of all previous sensor values is very desirable. This work involves developing for such a test-bed to support research on Autonomous Navigation schemes and Algorithms involved in these applications. Different approaches are analyzed and an optimum approach to design test-bed is implemented"--Abstract, leaf iii.
Local Sensor Data Fusion and Its Application to Autonomous Vehicle Navigation Nov 22 2022 ABSTRACT: The rate of development of autonomous vehicles over the last five years has been remarkable. Advancements have been made at such a pace that between DARPA's first Grand Challenge in 2004 and the Urban Challenge in 2007, vehicles have gone from failing to complete basic navigation tasks to successfully navigating urban streets. Significant progress has been made in the controls and planning areas, with navigation abilities improving as a partial result of improvements in Global Positioning precision. Hardware advancements have been made as well, with both computers and sensors

increasing data storage and processing capabilities. As a result, recent research has focused on combining the advanced computational abilities of computers with the increasingly relevant data provided by local sensors. This thesis deals with combining advancements in the fields of sensing and controls to improve upon existing autonomous navigation architectures. The Lane Finder Arbiter, a software component created for this research, provides an interface between raw sensing components and vehicle navigation components. The problem statement is first described, followed by a review of similar research and a description of prior research within the Center of Intelligent Machines and Robotics (CIMAR) that led to the creation of the Lane Finder Arbiter. The Lane Finder Arbiter, the focus of the thesis, is then described. The statistical methods used for this research are then discussed, and finally the results obtained from testing are analyzed. These results are used to draw conclusions about the Lane Finder Arbiter's current strengths, as well as possible future improvements to the new navigation architecture. *Autonomous Vehicles in Support of Naval Operations* Jan 01 2021 Autonomous vehicles (AVs) have been used in military operations for more than 60 years, with torpedoes, cruise missiles, satellites, and target drones being early examples.1 They have also been widely used in the civilian sector-for example, in the disposal of explosives, for work and measurement in radioactive environments, by various offshore industries for both creating and maintaining undersea facilities, for atmospheric and undersea research, and by industry in automated and robotic manufacturing. Recent military experiences with AVs have consistently demonstrated their value in a wide range of missions, and anticipated developments of AVs hold promise for increasingly significant roles in future naval operations. Advances in AV capabilities are enabled (and limited) by progress in the technologies of computing and robotics, navigation, communications and networking, power sources and propulsion, and materials. Autonomous Vehicles in Support of Naval Operations is a forward-looking discussion of the naval operational environment and vision for the Navy and Marine Corps and of naval mission needs and potential applications and limitations of AVs. This report considers the potential of AVs for naval operations, operational needs and technology issues, and opportunities for improved operations. Autonomous Vehicle Navigation Jun 29 2023 Improve the Safety, Flexibility, and Reliability of Autonomous Navigation in Complex EnvironmentsAutonomous Vehicle Navigation: From Behavioral to Hybrid Multi-Controller Architectures explores the use of multi-controller architectures in fully autonomous robot navigation-even in highly dynamic and cluttered environments. Accessible to researchers Fuzzy Logic Techniques for Autonomous Vehicle Navigation May 29 2023 In the past decade a critical mass of work that uses fuzzy logic for autonomous vehicle navigation has been reported. Unfortunately, reports of this work are scattered among conference, workshop, and journal publications that belong to different research communities (fuzzy logic, robotics, artificial intelligence, intelligent control) and it is therefore not easily accessible either to the new comer or to the specialist. As a result, researchers in this area may end up reinventing things while being unaware of important existing work. We believe that research and applications based on fuzzy logic in the field of autonomous vehicle navigation have now reached a sufficient level of maturity, and that it should be suitably reported to the largest possible group of interested practitioners, researches, and students. On these grounds, we have endeavored to collect some of the most representative pieces of work in one volume to be used as a reference. Our aim was to provide a volume which is more than "yet another random collection of papers," and gives the reader some added value with respect to the individual papers. In order to achieve this goal we have aimed at: • Selecting contributions which are representative of a wide range of prob lems and solutions and which have been validated on real robots; and • Setting the individual contributions in a clear framework, that identifies the main problems of autonomous robotics for which solutions based on fuzzy logic have

been proposed.
Robust Planning for Autonomous Navigation of Mobile Robots in Unstructured, Dynamic Environments Feb 23 2023 This report summarizes the analytical and experimental efforts for the Laboratory Directed Research and Development (LDRD) project entitled "Robust Planning for Autonomous Navigation of Mobile Robots In Unstructured, Dynamic Environments (AutoNav)". The project goal was to develop an algorithmic-driven, multi-spectral approach to point-to-point navigation characterized by: segmented on-board trajectory planning, self-contained operation without human support for mission duration, and the development of appropriate sensors and algorithms to navigate unattended. The project was partially successful in achieving gains in sensing, path planning, navigation, and guidance. One of three experimental platforms, the Minimalist Autonomous Testbed, used a repetitive sense-and-re-plan combination to demonstrate the majority of elements necessary for autonomous navigation. However, a critical goal for overall success in arbitrary terrain, that of developing a sensor that is able to distinguish true obstacles that need to be avoided as a function of vehicle scale, still needs substantial research to bring to fruition.
Robot Navigation from Nature Jan 13 2022 This pioneering book describes the development of a robot mapping and navigation system inspired by models of the neural mechanisms underlying spatial navigation in the rodent hippocampus. Computational models of animal navigation systems have traditionally had limited performance when implemented on robots. This is the first research to test existing models of rodent spatial mapping and navigation on robots in large, challenging, real world environments.
Machine Vision and Navigation Oct 10 2021 This book presents a variety of perspectives on vision-based applications. These contributions are focused on optoelectronic sensors, 3D & 2D machine vision technologies, robot navigation, control schemes, motion controllers, intelligent algorithms and vision systems. The authors focus on applications of unmanned aerial vehicles, autonomous and mobile robots, industrial inspection applications and structural health monitoring. Recent advanced research in measurement and others areas where 3D & 2D machine vision and machine control play an important role, as well as surveys and reviews about vision-based applications. These topics are of interest to readers from diverse areas, including electrical, electronics and computer engineering, technologists, students and non-specialist readers. • Presents current research in image and signal sensors, methods, and 3D & 2D technologies in vision-based theories and applications; • Discusses applications such as daily use devices including robotics, detection, tracking and stereoscopic vision systems, pose estimation, avoidance of objects, control and data exchange for navigation, and aerial imagery processing; • Includes research contributions in scientific, industrial, and civil applications.
Sensor Modelling, Design and Data Processing for Autonomous Navigation Sep 08 2021 This invaluable book presents an unbiased framework for modelling and using sensors to aid mobile robot navigation. It addresses the problem of accurate and reliable sensing in confined environments and makes a detailed analysis of the design and construction of a low cost optical range finder. This is followed by a quantitative model for determining the sources and propagation of noise within the sensor. The physics behind the causes of erroneous data is also used to derive a model for detecting and labelling such data as false. In addition, the author's data-processing algorithms are applied to the problem of environmental feature extraction. This forms the basis of a solution to the problem of mobile robot localisation. The book develops a relationship between the kinematics of a mobile robot during the execution of successive manoeuvres, and the sensed features. Results which update a mobile vehicle's position using features from 2D and 3D scans are presented. Contents:Sensor Design and Modelling:Range Sensing

in Confined EnvironmentsLidar Sensor Design — Electronic RequirementsLidar Sensor Design — Mechanical and Optical RequirementsQuantitative Sensor Modelling — Noise AnalysisQualitative Sensor Modelling — False DataMobile Robot Navigation Oriented Signal Processing:Environmental Feature ExtractionSensor Driven Mobile Robot LocalisationApplication: Mobile Robot Path PlanningConclusions and Future Research Directives Readership: Practitioners and researchers in robotics and artificial intelligence. Keywords:Autonomous Navigation;Mobile Robotics;LIDAR;LADAR;Sensor Modelling;Feature Detection;Multiple Path Effects;Robot Localisation;Feature Matching

Robotics Research Jun 05 2021 The Eighth International Symposium of Robotics Research was held in Kanagawa, Japan, on October 4-7 1997; Robotics Research presents the findings of this symposium. The papers, written by international specialists in the field, cover the many topics concerning advanced robotics today, ranging from practical system design to theoretical reasoning and planning. They assess the state of the field and discuss all the current and emerging trends dealing with, amongst many other topics, mobile robotics, manufacturing, learning from humans, autonomous land vehicles, humanoid robots, future robots, and new components. The reader will share with the attendees the meaningful steps forward in building the emerging body of concepts, methods, scientific and technical knowledge that shape modern day robotics.

Motion Analysis and Object Recognition for Autonomous Navigation Jul 27 2020 The research in computer vision described in this final report is directed towards the achievement of autonomous vehicle navigation using passive visual sensing. For a modeled environment, we have implemented a navigation system incorporating reactive planning, and based on the identification of known landmarks in the 3D scene. Robust algorithms have been demonstrated for the recovery of pose--the position and orientation of the camera--from model matching between the image and known environment. For an unknown environment, a navigation system has been demonstrated in which image based homing is used to move between neighboring target locations. For a completely unknown environment, multi frame structure from motion algorithms have been developed which use image sequences for the reconstruction of the camera motion and environmental structure. In a partially modeled environment, the combination of pose recovery with triangulation over image sequences yields a robust, accurate algorithm for incremental acquisition of a 3D scene model. Lastly, a new framework for obstacle detection from motion has been developed and demonstrated experimentally. In the area of static image interpretation and object recognition, research has been done on perceptual organization, invariant features, 3D reconstruction, and the automatic learning of strategies for object recognition. We have developed a new approach to distinguishing figure from ground, a prerequisite for obstacle detection, based on perceptual grouping techniques.

Intelligent Autonomous Systems Apr 03 2021 This research book contains a sample of most recent research in the area of intelligent autonomous systems. The contributions include: General aspects of intelligent autonomous systems Design of intelligent autonomous robots Biped robots Robot for stair-case navigation Ensemble learning for multi-source information fusion Intelligent autonomous systems in psychiatry Condition monitoring of internal combustion engine Security management of an enterprise network High dimensional neural nets and applications This book is directed to engineers, scientists, professor and the undergraduate/postgraduate students who wish to explore this field further.

Intelligent Unmanned Ground Vehicles Sep 01 2023 Intelligent Unmanned Ground Vehicles describes the technology developed and the

results obtained by the Carnegie Mellon Robotics Institute in the course of the DARPA Unmanned Ground Vehicle (UGV) project. The goal of this work was to equip off-road vehicles with computer-controlled, unmanned driving capabilities. The book describes contributions in the area of mobility for UGVs including: tools for assembling complex autonomous mobility systems; on-road and off-road navigation; sensing techniques; and route planning algorithms. In addition to basic mobility technology, the book covers a number of integrated systems demonstrated in the field in realistic scenarios. The approaches presented in this book can be applied to a wide range of mobile robotics applications, from automated passenger cars to planetary exploration, and construction and agricultural machines. Intelligent Unmanned Ground Vehicles shows the progress that was achieved during this program, from brittle specially-built robots operating under highly constrained conditions, to groups of modified commercial vehicles operating in tough environments. One measure of progress is how much of this technology is being used in other applications. For example, much of the work in road-following, architectures and obstacle detection has been the basis for the Automated Highway Systems (AHS) prototypes currently under development. AHS will lead to commercial prototypes within a few years. The cross-country technology is also being used in the development of planetary rovers with a projected launch date within a few years. The architectural tools built under this program have been used in numerous applications, from an automated harvester to an autonomous excavator. The results reported in this work provide tools for further research development leading to practical, reliable and economical mobile robots.

Framework for Autonomous Navigation of a Continuous Mining Machine Mar 15 2022

Advances in Intelligent Vehicles Sep 20 2022 Advances in Intelligent Vehicles presents recent advances in intelligent vehicle technologies that enhance the safety, reliability, and performance of vehicles and vehicular networks and systems. This book provides readers with up-to-date research results and cutting-edge technologies in the area of intelligent vehicles and transportation systems. Topics covered include virtual and staged testing scenarios, collision avoidance, human factors, and modeling techniques. The Series in Intelligent Systems publishes titles that cover state-of-the-art knowledge and the latest advances in research and development in intelligent systems. Its scope includes theoretical studies, design methods, and real-world implementations and applications. Provides researchers and engineers with up-to-date research results and state-of-the art technologies in the area of intelligent vehicles and transportation systems Covers hot topics, including driver assistance systems; cooperative vehicle-highway systems; collision avoidance; pedestrian protection; image, radar and lidar signal processing; and V2V and V2I communications

Autonomous Vehicle Test Bed May 24 2020 "Research and experiments on ... Autonomous Navigation Schemes and Algorithms need an efficient test-bed for objective performance analysis. These algorithms often require sensor inputs from the systems such as the speed and steering sensors to apply feedback control action. An efficient test-bed provides status of all sensors and records of all previous sensor values is very desirable. This work involves developing for such a test-bed to support research on Autonomous Navigation schemes and Algorithms involved in these applications. Different approaches are analyzed and an optimum approach to design test-bed is implemented"--Abstract, p. iii.

Autonomous Navigation in Dynamic Environments Mar 27 2023 This book presents a foundation for a broad class of mobile robot mapping and navigation methodologies for indoor, outdoor, and exploratory missions. It addresses the challenging problem of autonomous navigation

in dynamic environments, presenting new ideas and approaches in this emerging technical domain. Coverage discusses in detail various related challenging technical aspects and addresses upcoming technologies in this field.

Development of Autonomous Mobile Robot Navigation System Using RFID May 17 2022 Navigation techniques in mobile robotics system have gained significant research interest over the past few years. The mobile robot must be able to navigate through a known or unknown environment based on its necessities and applications. This can be achieved by determining its positions and selecting a suitable motion control. Conventional techniques include landmark or dead-reckoning with excessive number on sensors which increases complexities. Several other researchers have been done using both active and passive Radio Frequency Identification (RFID) Signal but there is still need for a more simple and suitable navigation system. This research has been done to present an effective navigation technique using passive RFID reader and tags. The proposed algorithm provides not only the estimation of the robot position in the environment but also the orientation of the autonomous robot. Polar coordinate system has been adopted on the navigation environment where the RFID tags are placed in a grid-like pattern with constant distance. The research objectives have been fulfilled via simulation and experimental validation through hardware implementation. The experimental results show effective and reliable results and the novelty lies in the use of simple technique to achieve the objectives. As a whole, this work has investigated and analyzed several navigation techniques and adopted the best technique for practical application with satisfactory results.

Study and Implementation of Potential Field Algorithms for Autonomous Mobile Robot Navigation Aug 27 2020 ABSTRACT This thesis describes an implementation of different robot motion planning algorithms, based on the potential field method, in a software layer that can be used with the Nomad robot. This is an experimental robot, designed for path planning research. The first three chapters cover the theoretical background of robot motion planning using the potential field method. Different algorithms will be explained with their different strengths and weaknesses. Chapter four will explain how these theoretical concepts have been implemented in a software layer. Actually, this chapter allows the reader to understand how the software is structured and designed using UML schemes. There is no programming skill required to understand this chapter and there is no direct link with the C programming language used, because an implementation should be possible in almost any language. Chapter five will describe a few test cases, where different algorithms behave differently in given situations. Their strengths and weaknesses are confirmed to be true. Chapter six will describe the implementation of the previously mentioned software layer into a real robot navigation system. Problems like sensor reading, obstacle detection and robot steering will be explained. Finally in the last chapter, again, tests are conducted using the different path planning algorithms, this time linked to a simulator robot using sensors, steering and collision detection.

Sensing and Control for Autonomous Vehicles Oct 29 2020 This edited volume includes thoroughly collected on sensing and control for autonomous vehicles. Guidance, navigation and motion control systems for autonomous vehicles are increasingly important in land-based, marine and aerial operations. Autonomous underwater vehicles may be used for pipeline inspection, light intervention work, underwater survey and collection of oceanographic/biological data. Autonomous unmanned aerial systems can be used in a large number of applications such as inspection, monitoring, data collection, surveillance, etc. At present, vehicles operate with limited autonomy and a minimum of intelligence. There is a growing interest for cooperative and coordinated multi-vehicle systems, real-time re-planning, robust autonomous

navigation systems and robust autonomous control of vehicles. Unmanned vehicles with high levels of autonomy may be used for safe and efficient collection of environmental data, for assimilation of climate and environmental models and to complement global satellite systems. The target audience primarily comprises research experts in the field of control theory, but the book may also be beneficial for graduate students.

Autonomous Navigation and Mapping in a Simulated Environment Nov 10 2021

Mechatronics Design and Energy-efficient Navigation of a Heavy-duty Omni-directional Mecanum Autonomous Mobile Robot Nov 30 2020 The Ilon Mecanum wheel is one of the practical omnidirectional wheel designs in industry but it consumes excessive energy due to its motion inefficiency. Omnidirectional autonomous mobile robots without any nonholonomic constraints can reach the same goal pose from the same start pose via too many feasible trajectories, each consuming different amounts of energy. It is both economically beneficial and academically interesting to optimize the omnidirectional trajectories of holonomic Mecanum autonomous mobile robots for energy minimization. The aim of this PhD research was to first develop a heavy-duty omnidirectional Mecanum mobile robot that can perform fully functional autonomous navigation for research purposes, and then to realize energy-efficient autonomous navigation on the designed robot via both online and offline optimal motion planning research studies. A heavy-duty omnidirectional Mecanum robot platform was designed and developed from the beginning. The robotic control system architecture that allows the robot to perform autonomous navigation was realized by fusing an industrial automation control system and open-source autonomous navigation technologies. Then an experimentally validated novel energy consumption model of the four-wheel omnidirectional Mecanum mobile robot was proposed based on a comprehensive understanding of the kinematics, dynamics and energy flow of the robot. In order to realize energy-efficient autonomous navigation, both online and offline optimal planners were presented in this research. The proposed online planner extended the Dynamic Window Approach (DWA) by means of a new energy-optimal omnidirectional velocity search technique for the purposes of optimizing motional power consumption and reducing energy consumption for autonomous navigation. The offline planner proposed a method of trajectory generation that interpolates the task-space trajectory of the omnidirectional robot in polynomial spline functions and then searches for the energy-optimal trajectories using genetic algorithms. Both proposed online and offline planning methods were experimentally validated.

Handbook of Research on Advanced Mechatronic Systems and Intelligent Robotics Sep 28 2020 Advanced research in the field of mechatronics and robotics represents a unifying interdisciplinary and intelligent engineering science paradigm. It is a holistic, concurrent, and interdisciplinary engineering science that identifies novel possibilities of synergizing and fusing different disciplines. The Handbook of Research on Advanced Mechatronic Systems and Intelligent Robotics is a collection of innovative research on the methods and applications of knowledge in both theoretical and practical skills of intelligent robotics and mechatronics. While highlighting topics including green technology, machine learning, and virtual manufacturing, this book is ideally designed for researchers, students, engineers, and computer practitioners seeking current research on developing innovative ideas for intelligent robotics and autonomous and smart interdisciplinary mechatronic products.

Autonomous Navigation of a Robot with Computer Vision Mar 03 2021 This TCC (Undergraduate Course Final Project) aims to develop a solution for intelligent autonomous navigation with mobile robots using computer vision. Using C language and OpenCV, an image

processing library, the generated code applies different filters and convolutions in the input image obtained by webcam in order to reduce input noise, homogenize regions and detect borders. The program, which can be adapted to different environments by regulating four parameters, allows the robot identifying the floor boundaries and therefore safely navigating avoiding obstacles in a defined area. Fitting in the research lines of the Laboratório de Robótica Móvel (ICMC-USP), this work aims to be useful in a near future at higher levels and in more important projects.

Navigation and Control of Autonomous Marine Vehicles Oct 22 2022 Robotic marine vessels can be used for a wide range of purposes, including defence, marine science, offshore energy and hydrographic surveys, and environmental surveys and protection. Such vessels need to meet a variety of criteria: they must be able to operate in salt water, and to communicate and be controlled over large distances, even when submerged or in inclement weather. Further challenges include 3D navigation of individual vehicles, groups or squadrons. This book covers the current state of research in navigation, modelling and control of marine autonomous vehicles, and deals with various related topics, including collision avoidance, communication, and a range of applications. It provides valuable insights for an audience of researchers, academics and postgraduate students interested in autonomous marine vessels, robotics, and electrical and automobile engineering.

Directed Sonar Sensing for Mobile Robot Navigation Apr 15 2022 This monograph is a revised version of the D.Phil. thesis of the first author, submitted in October 1990 to the University of Oxford. This work investigates the problem of mobile robot navigation using sonar. We view model-based navigation as a process of tracking naturally occurring environment features, which we refer to as "targets". Targets that have been predicted from the environment map are tracked to provide that are observed, but not predicted, vehicle position estimates. Targets represent unknown environment features or obstacles, and cause new tracks to be initiated, classified, and ultimately integrated into the map. Chapter 1 presents a brief definition of the problem and a discussion of the basic research issues involved. No attempt is made to survey ex haustively the mobile robot navigation literature-the reader is strongly encouraged to consult other sources. The recent collection edited by Cox and Wilfong [34] is an excellent starting point, as it contains many of the standard works of the field. Also, we assume familiarity with the Kalman filter. There are many well-known texts on the subject; our notation derives from Bar-Shalom and Fortmann [7]. Chapter 2 provides a detailed sonar sensor model. A good sensor model of our approach to navigation, and is used both for is a crucial component predicting expected observations and classifying unexpected observations.

Autonomous Vehicle Technology Jan 30 2021 Autonomous vehicle technology has the potential to significantly improve social welfare. This report addresses the numerous legislative, regulatory, and liability issues this technology will raise.

Virtual Autonomous Navigation Environment Jan 25 2023 VANE Research Focus: Integrate vehicle mobility, ground physics, terrain physics and sensor response models into a High Performance Computing computational testbed to facilitate virtual testing of UMS for autonomous navigation performance.

Vision-based Autonomous Navigation and Active Sensing with Micro Aerial Vehicles Aug 20 2022 Micro aerial vehicles (MAVs) equipped with cameras provide a new perspective on the world. As MAVs have found important roles in industrial and recreational applications, they are actively studied in the research community. The focus has been the autonomy level. In other words, the MAV should be able to perform tasks autonomously to free human from laborious and risky work. At the basis of an autonomous system, there is the problem

of autonomous navigation. In outdoor spaces, MAVs usually use GPS signals for self-localization. In indoor GPS-denied environments, autonomous navigation of MAVs is still an open research question. At the high level of an autonomous system, there is the problem of active sensing. An autonomous platform needs to actively optimize its navigation based on its current state and the environment. The constraints of vision sensors and complex environments pose challenges to this task. In this thesis, we propose our solutions to the two problems: vision based navigation and active sensing. In the first half of the thesis, we propose solutions of vision based navigation on two platforms. First, we present an ultra-light and -small MAV platform which can perform autonomous navigation in an unknown indoor environment. Secondly, we aim at a toy MAV. Accurate path following is achieved using the camera as the major sensor. In the second half, we address the active sensing problem in two interesting applications. We first investigate the active target sensing and following using a multi-robot collaborative system. The only sensors are cameras and the constraints of vision algorithms are taken into consideration while we design the motion controller. Lastly, we demonstrate an active image data acquisition system in the image based modeling application. The camera placement is optimized in the loop and online feedback is provided for the sensor planning. We demonstrate the fully autonomous active image based modeling system in simulated, indoor and outdoor environments.

Safe Robot Navigation Among Moving and Steady Obstacles Apr 27 2023 Safe Robot Navigation Among Moving and Steady Obstacles is the first book to focus on reactive navigation algorithms in unknown dynamic environments with moving and steady obstacles. The first three chapters provide introduction and background on sliding mode control theory, sensor models, and vehicle kinematics. Chapter 4 deals with the problem of optimal navigation in the presence of obstacles. Chapter 5 discusses the problem of reactively navigating. In Chapter 6, border patrolling algorithms are applied to a more general problem of reactively navigating. A method for guidance of a Dubins-like mobile robot is presented in Chapter 7. Chapter 8 introduces and studies a simple biologically-inspired strategy for navigation a Dubins-car. Chapter 9 deals with a hard scenario where the environment of operation is cluttered with obstacles that may undergo arbitrary motions, including rotations and deformations. Chapter 10 presents a novel reactive algorithm for collision free navigation of a nonholonomic robot in unknown complex dynamic environments with moving obstacles. Chapter 11 introduces and examines a novel purely reactive algorithm to navigate a planar mobile robot in densely cluttered environments with unpredictably moving and deforming obstacles. Chapter 12 considers a multiple robot scenario. For the Control and Automation Engineer, this book offers accessible and precise development of important mathematical models and results. All the presented results have mathematically rigorous proofs. On the other hand, the Engineer in Industry can benefit by the experiments with real robots such as Pioneer robots, autonomous wheelchairs and autonomous mobile hospital. First book on collision free reactive robot navigation in unknown dynamic environments Bridges the gap between mathematical model and practical algorithms Presents implementable and computationally efficient algorithms of robot navigation Includes mathematically rigorous proofs of their convergence A detailed review of existing reactive navigation algorithm for obstacle avoidance Describes fundamentals of sliding mode control

Vision Based Autonomous Robot Navigation Jul 31 2023 This monograph is devoted to the theory and development of autonomous navigation of mobile robots using computer vision based sensing mechanism. The conventional robot navigation systems, utilizing traditional sensors like ultrasonic, IR, GPS, laser sensors etc., suffer several drawbacks related to either the physical limitations of the sensor or incur high cost. Vision sensing has emerged as a popular alternative where cameras can be used to reduce the overall cost, maintaining high degree of

intelligence, flexibility and robustness. This book includes a detailed description of several new approaches for real life vision based autonomous navigation algorithms and SLAM. It presents the concept of how subgoal based goal-driven navigation can be carried out using vision sensing. The development concept of vision based robots for path/line tracking using fuzzy logic is presented, as well as how a low-cost robot can be indigenously developed in the laboratory with microcontroller based sensor systems. The book describes successful implementation of integration of low-cost, external peripherals, with off-the-shelf procured robots. An important highlight of the book is that it presents a detailed, step-by-step sample demonstration of how vision-based navigation modules can be actually implemented in real life, under 32-bit Windows environment. The book also discusses the concept of implementing vision based SLAM employing a two camera based system.

Mars Exploration Jun 17 2022 More than 50 years after the Mariner 4 flyby on 15 July 1965, Mars still represents the next frontier of space explorations. Of particular focus nowadays is crewed missions to the red planet. Over three sections, this book explores missions to Mars, in situ operations, and human-rated missions. Chapters address elements of design and possible psychological effects related to human-rated missions. The information contained herein will allow for the development of safe and efficient exploration missions to Mars.

Advances in Intelligent Autonomous Systems Jun 25 2020 This collection of twenty-three timely contributions covers a well-selected repertory of topics within the autonomous systems field. The book discusses a range of design, construction, control, and operation problems along with a multiplicity of well-established and novel solutions.

NAVLAB: an Autonomous Navigation Testbed Jul 19 2022 The NavLab is a testbed for research in outdoor navigation, image understanding, and the role of human interaction with intelligent systems; it accommodates researchers and all computing onboard. The core of the NavLab is the vehicle controller, a multi-processor computer that controls all locomotion, actuation and physical sensing; it interacts with a computer host and and human operator to implement varying degrees of autonomy. The chassis is a modified van with a computer-controllable, hydraulic drivetrain. The NavLab supports a choice os sensing to accommodate many types of navigation research. This technical report details the control computing and physical configuration of the NavLab vehicle.

Indoor Navigation Strategies for Aerial Autonomous Systems Feb 11 2022 Indoor Navigation Strategies for Aerial Autonomous Systems presents the necessary and sufficient theoretical basis for those interested in working in unmanned aerial vehicles, providing three different approaches to mathematically represent the dynamics of an aerial vehicle. The book contains detailed information on fusion inertial measurements for orientation stabilization and its validation in flight tests, also proposing substantial theoretical and practical validation for improving the dropped or noised signals. In addition, the book contains different strategies to control and navigate aerial systems. The comprehensive information will be of interest to both researchers and practitioners working in automatic control, mechatronics, robotics, and UAVs, helping them improve research and motivating them to build a test-bed for future projects. Provides substantial information on nonlinear control approaches and their validation in flight tests Details in observer-delay schemes that can be applied in real-time Teaches how an IMU is built and how they can improve the performance of their system when applying observers or predictors Improves prototypes with tactics for proposed nonlinear schemes

Handbook of Research on Advancements in Robotics and Mechatronics May 05 2021 The field of mechatronics integrates modern

engineering science and technologies with new ways of thinking, enhancing the design of products and manufacturing processes. This synergy enables the creation and evolution of new intelligent human-oriented machines. The Handbook of Research on Advancements in Robotics and Mechatronics presents new findings, practices, technological innovations, and theoretical perspectives on the the latest advancements in the field of mechanical engineering. This book is of great use to engineers and scientists, students, researchers, and practitioners looking to develop autonomous and smart products and systems for meeting today’s challenges.

Autonomous Navigation Using Image Processing Dec 24 2022 In the recent years, the pursuit intelligent and self-operated machines have increased. The human user is to be completely eliminated or minimized as much as possible. It is also popular now to observe machines that are able to do variety of tasks, instead of just one. A division of intelligent robotics is autonomous navigation. Google, Tesla, Honda, and many other large corporations are trying to master this field, since the search for a self-driving vehicle is profitable as much as it is difficult. The research presented in this thesis is autonomous navigation for mobile robots in an indoor environment, but not limited to. Some explored algorithms focus on navigating in environment that has been already explored and mapped. Algorithms such as modified A-Star and goal-based navigational vector field were tested for how effectively a path is planned from one point to another. The algorithms were compared and analyzed for how well the robot avoided obstacles and the length of the path taken. Other algorithms were also developed and tested for navigation without a map. The navigational algorithms are simulated on different artificial environments as well as on real environments. Machine learning is used to learn and adapt to the robot's motion behaviours, which enables the robot to perform movements as intended by the implemented navigational algorithms. Referred to in this thesis as the intelligence engine, a feed-forward artificial neural network was created to predict power delivery to the motors. Back-propagation algorithm is used alongside the neural network to enable supervised learning. Similar to human vision, the algorithm relies mainly on image processing to obtain data about the surrounding environment. The data human eyes provide helps one perceive and understand the surroundings. Similarly, a Kinect sensor is used in this thesis to get 2-dimensional colour data as well as depth data. A program was implemented to process and understand this arbitrary sequential array of numbers in terms of quantifiable values. The robot in return is capable of understanding target, obstructions, and is capable of navigation. All external data are gathered from one optical sensor. Many different algorithms were implemented and tested to efficiently detect and track a target. The idea is to make an artificial robot perceive its' surrounding using 3-Dimentional image data and intelligently navigate the local surroundings.

Autonomous Robots Research Advances Jul 07 2021 Autonomous robots are robots which can perform desired tasks in unstructured environments without continuous human guidance. Many kinds of robots have some degree of autonomy. Different robots can be autonomous in different ways. A high degree of autonomy is particularly desirable in fields such as space exploration, where communication delays and interruptions are unavoidable. Some modern factory robots are "autonomous" within the strict confines of their direct environment. The exact orientation and position of the next object of work and (in the more advanced factories) even the type of object and the required task must be determined. This can vary unpredictably (at least from the robot's point of view). One important area of robotics research is to enable the robot to cope with its environment whether this be on land, underwater, in the air, underground, or in space. This book presents the latest research from around the globe.

The DARPA Urban Challenge Apr 23 2020 By the dawn of the new millennium, robotics has undergone a major transformation in scope and

dimensions. This expansion has been brought about by the maturity of the field and the advances in its related technologies. From a largely dominant industrial focus, robotics has been rapidly expanding into the challenges of the human world. The new generation of robots is expected to safely and dependably co-habitat with humans in homes, workplaces, and communities, providing support in services, entertainment, education, healthcare, manufacturing, and assistance. Beyond its impact on physical robots, the body of knowledge robotics has produced is revealing a much wider range of applications reaching across diverse research areas and scientific disciplines, such as: biomechanics, haptics, neurosciences, virtual simulation, animation, surgery, and sensor networks among others. In return, the challenges of the new emerging areas are proving an abundant source of stimulation and insights for the field of robotics. It is indeed at the intersection of disciplines that the most striking advances happen. The goal of the series of Springer Tracts in Advanced Robotics (STAR) is to bring, in a timely fashion, the latest advances and developments in robotics on the basis of their significance and quality. It is our hope that the wider dissemination of research developments will stimulate more exchanges and collaborations among the research community and contribute to further advancement of this rapidly growing field.

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