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Design, Construction, and Testing of a Novel Robotic Workstation

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Abstract

This paper describes the development of a novel robotic workstation which users configure to a variety of spatial forms. These configurations allow users to define their physical workspace as well as to situate computer and analogue tools precisely to support a broad range of work-and-leisure computing activities. The workstation is part of our Animated Work Environment (AWE) project aimed at programmable smart environments which fundamentally alter user experience. This paper describes, in detail, the design, realization, and initial testing of the multi-panel robot workstation which itself represents a novel type of robot surface.

Keywords: robotics, animation, human-robotic interaction, intelligent environments

1 Introduction

In an increasingly "digital" society, many of our everyday activities are becoming more efficient, streamlined, and complex due to the wide-spread adoption of mobile Information Technologies [IT]. People can answer e-mails, search the internet, record media such as audio files, photographs and videos, and edit documents on-the-move, using relatively inexpensive cell phones, PDAs and laptop computers – portable devices easily synchronized. But while Information Technologies have greatly expanded the mobility of computing, it has not offered as much to the relatively static, fixed work environments residing within our workplaces and homes. Here, printed materials and computer peripherals still clutter desks, while traditional furniture and lighting crowd rooms. A different kind of workplace incorporating intelligent, reconfigurable elements promises to better adapt to an increasingly digital world, allowing computer users to become more efficient, more organized, and potentially more creative.

Upon first approach, the robot workstation introduced in this paper appears to be nothing more than a flat wall (Figure 1). When the user takes control it transforms into a personalized, intimate space for the focused composing of documents (Figure 2); or, alternatively, a configuration designed for presenting to an audience (Figure 13a). The workstation efficiently utilizes space by dramatically transforming itself to match the needs and wants of different users. Computing, digital projection, and lighting will emanate from within the workstation itself.

The design concept is not limited to the office. The workstation can function inside distinct rooms of different sizes and purposes because it can adapt its physical form. At home, for instance, the workstation supports home-office tasks; when these tasks are accomplished, the system provides configurations suited to online gaming (Figure 13b), shopping, viewing, tutoring, and creative/investigative activities.

The concept of a dynamically reconfigurable, intelligent environment is the focus of the larger *Animated Work Environment* (AWE) research project [1], [2]. The multidisciplinary research team is comprised of investigators in Architecture, Robotics, Sociology, and Psychology. In the first year of research, the Sociologists conducted detailed phone surveys of technology users while the Psychologists performed task analyses of a range of subjects chosen to represent a large spectrum of workers performing everyday tasks within their physical work environments [3]. These efforts helped the team identify the needs and wants of workers with respect to the physical environments in which they routinely perform their work. The results strongly support the need for embedded IT within a physical environment that is both intelligent and readily reconfigurable.

Figure1: Workstation design as a flat wall

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Evangelos Pantazis

Design Construction And Testing Of A Novel Robotic:

Robotics and Automation Handbook Thomas R. Kurfess,2018-10-03 As the capability and utility of robots has increased dramatically with new technology robotic systems can perform tasks that are physically dangerous for humans repetitive in nature or require increased accuracy precision and sterile conditions to radically minimize human error The Robotics and Automation Handbook addresses the major aspects of designing fabricating and enabling robotic systems and their various applications It presents kinetic and dynamic methods for analyzing robotic systems considering factors such as force and torque From these analyses the book develops several controls approaches including servo actuation hybrid control and trajectory planning Design aspects include determining specifications for a robot determining its configuration and utilizing sensors and actuators The featured applications focus on how the specific difficulties are overcome in the development of the robotic system With the ability to increase human safety and precision in applications ranging from handling hazardous materials and exploring extreme environments to manufacturing and medicine the uses for robots are growing steadily The Robotics and Automation Handbook provides a solid foundation for engineers and scientists interested in designing fabricating or utilizing robotic systems Robotic Fabrication in Architecture, Art and Design 2014 Wes McGee,Monica Ponce de Leon,2014-03-20 Robotic automation has become ubiquitous in the modern manufacturing landscape spanning an overwhelming range of processes and applications from small scale force controlled grinding operations for orthopedic joints to large scale composite manufacturing of aircraft fuselages Smart factories seamlessly linked via industrial networks and sensing have revolutionized mass production allowing for intelligent adaptive manufacturing processes across a broad spectrum of industries Against this background an emerging group of researchers designers and fabricators have begun to apply robotic technology in the pursuit of architecture art and design implementing them in a range of processes and scales Coupled with computational design tools the technology is no longer relegated to the repetitive production of the assembly line and is instead being employed for the mass customization of non standard components This radical shift in protocol has been enabled by the development of new design to production workflows and the recognition of robotic manipulators as multi functional fabrication platforms capable of being reconfigured to suit the specific needs of a process The emerging discourse surrounding robotic fabrication seeks to question the existing norms of manufacturing and has far reaching implications for the future of how architects artists and designers engage with materialization processes This book presents the proceedings of Rob Arch2014 the second international conference on robotic fabrication in architecture art and design It includes a Foreword by Sigrid Brell Cokcan and Johannes Braumann Association for Robots in Architecture The work contained traverses a wide range of contemporary topics from methodologies for incorporating dynamic material feedback into existing fabrication processes to novel interfaces for robotic programming to new processes for large scale automated construction The latent argument behind this research is that the term file to factory must not be a reductive celebration of expediency

but instead a perpetual challenge to increase the quality of feedback between design matter and making **Advances in Robot Design and Intelligent Control** Aleksandar Rodić,Theodor Borangiu,2016-11-26 This book presents the proceedings of the 25th International Conference on Robotics in Alpe Adria Danube Region RAAD 2016 held in Belgrade Serbia on June 30th July 2nd 2016 In keeping with the tradition of the event RAAD 2016 covered all the important areas of research and innovation in new robot designs and intelligent robot control with papers including Intelligent robot motion control Robot vision and sensory processing Novel design of robot manipulators and grippers Robot applications in manufacturing and services Autonomous systems humanoid and walking robots Human robot interaction and collaboration Cognitive robots and emotional intelligence Medical human assistive robots and prosthetic design Robots in construction and arts and Evolution education legal and social issues of robotics For the first time in RAAD history the themes cloud robots legal and ethical issues in robotics as well as robots in arts were included in the technical program The book is a valuable resource for researchers in fields of robotics engineers who implement robotic solutions in manufacturing services and healthcare and master s and Ph D students working on robotics projects **Towards Autonomous Robotic Systems** Manuel Giuliani,Tareq Assaf,Maria Elena Giannaccini,2018-07-21 This book constitutes the refereed proceedings of the 19th Annual Conference on Towards Autonomous Robotics TAROS 2018 held in Bristol UK in July 2018 The 38 full papers presented together with 14 short papers were carefully reviewed and selected from 68 submissions The papers focus on presentation and discussion of the latest results and methods in autonomous robotics research and applications The conference offers a friendly environment for robotics researchers and industry to take stock and plan future progress **Vectored Propulsion, Supermaneuverability and Robot Aircraft** Benjamin Gal-Or,2013-11-09 This book is designed to fill a professional vacuum in the new field of advance high angle vectored stealth aircraft The subject matter presented in the volume has never before been investigated and presented as a unified field of study because it covers entirely new fields and because specialized fragments of this unified field are scattered throughout literature in specific problems The book is of interest to aeronautical and mechanical engineers electrical and control engineers aerospace industry USAF US Navy NASA pilots and instructors

Proceedings of MSR-RoManSy 2024 Pierre Larochelle,J. Michael McCarthy,Craig P. Lusk,2024-05-28 This book gathers the latest fundamental research contributions innovations and applications in the field of design and analysis of complex robotic mechanical systems machines and mechanisms as presented by leading researchers at the combined IFToMM Symposium of RoManSy and USCToMM Symposium on Mechanical Systems and Robotics MSR RoManSy held in St Petersburg FL USA on May 22 25 2024 It covers highly diverse topics including soft wearable and origami robotic systems applications to walking flying climbing underground swimming and space systems human rehabilitation and performance augmentation design and analysis of mechanisms and machines human robot collaborative systems service robotics mechanical systems and robotics education and the commercialization of mechanical systems and robotics The contributions

which were selected by means of a rigorous international peer review process highlight numerous exciting and impactful research results that will inspire novel research directions and foster multidisciplinary research collaborations among researchers from around the globe **The Little Book of Almost Everything** carl scutt,2023-02-15 Your guide to social mobility on every occasion Never be stuck for something to say in the company of strangers and new friends with The little book of almost everything Knowing everything is impossible but knowing a little about a lot gives you the upper hand in any situation With The little book of almost everything you will be in the procession of basic knowledge and understanding of a wide range of subjects making you the person with the broadest range and appeal This book is a comprehensive exploration of multiple subjects including Art Humanities Technology Science Health Philosophy Civilisations and Humans By examining the intersections between these areas I hope to offer a broad understanding of the world we inhabit and our place in it Whether you are an academic a curious reader or someone who simply seeks to expand your horizons this book provides a wealth of knowledge and insights to enhance your understanding of the multifaceted world around us So come on this journey of discovery and explore the many fascinating facets of human experience *The Official Raspberry Pi Projects Book Volume 1* The Makers of The MagPi magazine,2015-11-01 The Official Raspberry Pi projects book returns with inspirational projects detailed step by step guides and product reviews based around the phenomenon that is the Raspberry Pi See why educators and makers adore the credit card sized computer that can be used to make robots retro games consoles and even art In this volume of The Official Raspberry Pi Projects Book you ll Get involved with the amazing and very active Raspberry Pi community Be inspired by incredible projects made by other people Learn how to make with your Raspberry Pi with our tutorials Find out about the top kits and accessories for your Pi projects And much much more If this is your first time using a Raspberry Pi you ll also find some very helpful guides to get you started with your Raspberry Pi journey With millions of Raspberry Pi boards out in the wild that s millions more people getting into digital making and turning their dreams into a Pi powered reality Being so spoilt for choice though means that we ve managed to compile an incredible list of projects guides and reviews for you This book was written using an earlier version of Raspberry Pi OS Please use Raspberry Pi OS Legacy for full compatibility See magpi cc legacy for more information **Designing with Multi-Agent Systems** Evangelos Pantazis,2024-02-19 The book presents a theoretical and technical background for applying MAS Multi Agent Systems in Architecture Engineering and Construction It focuses in the early design stage and makes use of domain specific data which relate to different design domains structural environmental architectural design to inform the agent behaviors The proposed framework is applicable especially to design problems which traditionally require the close collaboration of engineers and architects Generation GrowBots: Materials, Mechanisms, and Biomimetic Design for Growing Robots Barbara Mazzolai,Ian Walker,Thomas Speck,2021-08-18 The De Gruyter Handbook of Robots in Society and Culture Leopoldina Fortunati,Autumn Edwards,2024-09-23 The De Gruyter Handbook of Robots in Society and Culture provides a

comprehensive discussion of how social robots take form function and meaning for individuals relationships cultures and societies Through a path breaking integration of perspectives coming from sociology communication and media psychology cognitive neuroscience anthropology political science and science and technology studies it focuses on the critical and social meaning of present developments in social robotic technologies This book looks at artificial agents from voice based assistants to humanoid robots as their use transforms private and public contexts and gives rise to both new possibilities and new perils for human being and becoming organizations as well as social structures and institutions The handbook traces the consequences and key problems of social robotics across broad social contexts in both public and political as well as domestic and intimate spaces Further it attends carefully to the implications of social robotics for various human identity groups including those based on gender ethnicity culture class ability and age Deep attention to interdisciplinarity inclusivity ethics and socio cultural futures serves as the guiding inspiration behind each contribution within this handbook Fabricate 2024 Bob Sheil,Marilena Skavara,Mette Ramsgaard Thomsen,Phil Ayres,2024-04-04 Fabricate 2024 Creating Resourceful Futures is the fifth volume in the series of Fabricate publications The first conference Making Digital Architecture explored the ways in which technology design and industry are shaping the world around us Since then we have become finely attuned to the negative impacts of this shaping The 2024 conference hosted in Copenhagen sets focus on the pressing need to develop new models for architectural production that rethink how resource is deployed its intensity its socio ecological origins and sensitivity to environment This book features the work of designers engineers and makers operating within the built environment It documents disruptive approaches that reconsider how fabrication can be leveraged to address our collective and entangled challenges of resource scarcity climate emergency and burgeoning demand Exploring case studies of completed buildings and works in progress together with interviews with leading thinkers this edition of Fabricate offers a plurality of tangible models for design and production that set a creative and responsible course towards resourceful futures

Robots in K-12 Education: A New Technology for Learning Barker, Bradley S.,Nugent, Gwen,Grandgenett, Neal,Adamchuk, Viacheslav I.,2012-02-29 This book explores the theory and practice of educational robotics in the K 12 formal and informal educational settings providing empirical research supporting the use of robotics for STEM learning Provided by publisher Fabricate 2020 Jane Burry,Jenny E. Sabin,Bob Sheil,Marilena Skavara,2020-04-06 Fabricate 2020 is the fourth title in the FABRICATE series on the theme of digital fabrication and published in conjunction with a triennial conference London April 2020 The book features cutting edge built projects and work in progress from both academia and practice It brings together pioneers in design and making from across the fields of architecture construction engineering manufacturing materials technology and computation Fabricate 2020 includes 32 illustrated articles punctuated by four conversations between world leading experts from design to engineering discussing themes such as drawing to production behavioural composites robotic assembly and digital craft Advanced Manufacturing and Automation XIV Yi Wang,Tao

Yu,Kesheng Wang,2025-02-14 The book is a compilation of selected papers from the 14th International Workshop of Advanced Manufacturing and Automation IWAMA 2024 held in Kunming University of Science and Technology China on 11 12 October 2024 Topics focusing on novel techniques for manufacturing and automation in Industry 4 0 are now vital factors for the maintenance and improvement of the economy of a nation and the quality of life It will help academic researchers and engineering to implement the concept theory and methods in Industry 4 0 which has been a hot topic These proceedings will make valuable contributions to academic researchers engineers in the industry for the challenges in the 4th industry revolution and smart factories **Scientific and Technical Aerospace Reports** ,1995 **STEM Education with Robotics** Purvee Chauhan,Vikram Kapila,2023-05-11 This book offers a synthesis of research curriculum examples pedagogy models and classroom recommendations for the effective use of robotics in STEM teaching and learning Authors Chauhan and Kapila demonstrate how the use of educational robotics can catalyze and enhance student learning and understanding within the STEM disciplines The book explores the implementation of design based research DBR technological pedagogical and content knowledge TPACK and the 5E instructional model among others Chapters draw on a variety of pedagogical scaffolds to help teachers deploy educational robotics for classroom use including research driven case studies strategies and standards aligned lesson plans from real life settings This book will benefit STEM teachers STEM teacher educators and STEM education researchers *NSF Program Solicitation* National Science Foundation (U.S.),1987 Telerobotics, Automation, and Human Supervisory Control Thomas B. Sheridan,1992 For the past three decades the author and his colleagues in the MIT Man Machine Systems Laboratory have been carrying out experimental research in the area of teleoperation telerobotics and supervisory control a new form of technology that allows humans to work through machines in hazardous environments and control complex systems such as aircraft and nuclear power plants This timely reference brings together a variety of theories and technologies that have emerged in a number of fields of application describing common themes presenting experiments and hardware embodiments as examples and discussing the advantages and the drawbacks of this new form of human machine interaction There are many places such as outer space the oceans and nuclear biologically and chemically toxic environments that are inaccessible or hazardous to humans but in which work needs to be done Telerobotics remote supervision by human operators of robotic or semi automatic devices is a way to enter these difficult environments Yet it raises a host of problems such as the retrieval of sensory information for the human operator and how to control the remote devices with sufficient dexterity In its complete coverage of the theoretical and technological aspects of telerobotics and human computer cooperation in the control of complex systems this book moves beyond the simplistic notion of humans versus automation to provide the necessary background for exploring a new and informed cooperative relationship between humans and machines **Energy Research Abstracts** ,1995

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