Emre Koyuncu

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Research interests

Developing computationally efficient/optimal autonomous planning algorithms especially for vehicles have complex dynamics (agile aerial vehicles, robots etc.) flying/moving in the complex environments, real-time robotics implementations (developing hardware/software) for autonomous motion/flying, cooperated/uncooperated multi-agents and game theoretic applications

Education

Ph.D. at Istanbul Technical University, Istanbul   **2008 - present**

Ph.D. Computer Science

with the **Undergraduate Minor Program, Computer Science (2008-2009),**
One year PhD preliminary program for students admitted from different majors. Program includes main undergraduate courses from Computer Science.

M.Sc. at Istanbul Technical University, Istanbul   **2005 - 2008**

M.Sc. Mechatronics Engineering
Thesis; Probabilistic Motion Planning for Unmanned Aerial Vehicles Flying in Complex Environments, under advising; Prof. Gokhan Inalhan at Controls and Avionics Lab.

B.Sc. at Istanbul Technical University, Istanbul   **2000 - 2005**

Undergraduate Electrical Engineering
Thesis; Computer Vision Based Object Orbital Tracker Robot Arm Design, under advising; Prof. Hakan Temeltas at Robotics Lab.

Aydin City Science High School, Aydin   **1997 - 2000**

High School

Academic Honors and Awards

Research Fellowship   **2009 to present**

The Scientific and Technological Research Council of Turkey (TUBITAK), Design a Nano Satellite Project; ITUSAT II

Research Fellowship   **2006 - 2009**

Istanbul Technical University, Rotary Aircrafts Design Excellence Center (ROTAM), Light Commercial Helicopter (LCH) Project

Best 3rd place Journal   **March 2006**

National Defense Science Research Awards 2006, organized by Turkish Armed Forces, with the journal; "Computer Vision Based Artificial Neural Networks Controlled Intelligent Object Tracker Turret Design", co-authors; R. Yeniceri and O. Ceylan.

Best 3rd place R&D Project   **May 2005**

National Projekent 2005 Best R&D Projects Awards, organized by IEEE Turkey Student Section, with the "Computer Vision Based Object Tracking Robot Arm" project, co-researchers; Yeniceri R., Ceylan O., May 2005

Professional Experiences

Research Assistant   **2006 to present**

Controls and Avionics Laboratory, Faculty of Aeronautics and Astronautics, Istanbul Technical University

Mechatronics R&D Engineer   **2005 - 2006**

Electronics and Mechatronics Department, ZER Robotics & Automation Ltd. Co.

Projects

- **Autonomous Flight System Design for Micro Aerial Vehicles,** It is progressing in Controls and Avionics Lab. This work is aiming to develop a prototype testing of flight ready micro-UAV autopilot using embedded targeting and integration with mission simulation environment.

- **Attitude Determination and Control (ADCS) Computer Design for a Nano Satellite; ITUSAT II,** It is progressing in ITU Controls and Avionics Lab joint with Space Systems Design and Test Lab. in ITU. This project aims to create a satellite platform that can achieve own attitude determination, control and high-resolution photographing on its orbit. ADCS computer will organize and manage of its attitude determination and control processes in order to obtain safe flight and fault detection ability. This platform is planned to lunch in first quarter of 2011.

- **ITUCAL Robotic Hardware Testbed for Implementing Real-time Planning Strategies,** It was developed in ITU Controls and Avionics Lab. in 2008-2009. This testbed includes fully autonomous decentralized controlled small mobile agents and centralized visual positioning and planning computers in a wireless network. All robots have own control hardware/software equipments and are able to implement received centralized trajectory plan while visual positioning computer can detect their positions and orientations.

- **Computationally Efficient Motion Planning Algorithms for Agile Unmanned Aerial Vehicles in Flying in Complex 3D Environments,** It was developed in ITU Controls and Avionics Lab. in 2008-2009. Computationally efficient trajectory generation algorithms, which consider dynamics of the vehicles and combine both probabilistic and deterministic aspects using with multi-modal maneuver automata framework, were developed for highly agile unmanned aerial vehicles.

- **Design and Control of an Autonomous Mobil Robot in War-like Environment,** It was developed in System Dynamics and Control Lab. in ITU with a research group. In this project, one mobile robot was designed which can visually track a person for people assisting while it avoids from obstacles.

- **Developing Earthquake Actuated Gas Shut of and Safety System (DAGSIS) Design,**
  It was completed and managed in ZER Machine Robotic and Automation Ltd. Co., March 2006, it has currently being used in buildings as earthquake safety product in Turkey and it was also certificated by Institute of Turkish Standards (TS.34/14/8132).

Some projects from undergraduate activities

- *Vision Based Intelligent Object Tracker Turret Design*,
  This project is completed as undergraduate thesis in 2005, it won Best 3rd place student R&D project prize in IEEE Turkey Student Branch Projekent R&D Awards 2005, in May 2005 and Best 3rd place Journal Price in National Defense Science Research Awards 2006, March 2006. Project was completed with a research group, supported and partially funded by Istanbul Technical University.

- **Electrical Design of NUSRAT (solar powered boat),**
  Electrical control and Maximum Power Point Tracker (MPPT) systems were designed, with a team member E. Demirok during 2004 – 2006 (project is completed in 2007 and won many world-wide awards such as Solar Splash '07 World Competition best 3rd place etc.), Supported by many companies.

- **Abu Asia Pacific Robocon '04&05 Robotic Competitions,**
  In these competitions, as ITU IEEE Student Branch team, one manual and two autonomous robots (as big as human size but not complex as humanoid) were designed in order to complete the missions based on Asian mysteries for every year

Professional Affiliations and Services

- International Conference on Unmanned Aerial Vehicles (UAV'09),
  Reviewer (2009)

- IEEE (The Institute of Electrical & Electronic Engineers, Inc.), Robotic and Automation Society (IEEE-RAS)
  5 years member (2004 - ...)

- International Energy and Environmental Technologies Union (UECTB),
  Vice-president (2009 - ...) and founder member

- International Technology Union (UTB),
  Member of director (2006-2008) and founder member

- Istanbul Technical University IEEE Student Branch,
  Student Chair (2003-2005), Member (2001 - 2005, during undergraduate)

Extracurricular Activities

- Amateur photographer (owning a SLR camera)
- Amateur telescope maker (one 6" Newtonian project is completed)
- Pipe collector (owning some Turkish, Italian, Denmark and Chinese pipes)
- Turkish classical music, *Baglama (a traditional instrument) player, Turkish Aegean folk dancer*

Miscellaneous

- ***Current Erdos Number is 6*** *through; Laszlo Pyber, Julia Kempe, Shankar Sastry, Claire J. Tomlin, Gokhan Inalhan*

- Listed in **Marquis Who's Who in the World 2008**

- Participant, **8th International UJI Summer School on Rescue Robotics 2008**,
  Benicassim, Spain, September 15-19, 2008

- Participant, **Player Summer School on Cognitive Robotics 2007**,
  Technical University of Munich, Munich, Germany, August 13-20, 2007

Publications

Journals and Book Chapters

Koyuncu E., Ure, N. K., Inalhan, G**., *Integration of Path/Maneuver Planning in Complex Environments for Agile Maneuvering UCAVs***, Journal of Intelligent and Robotics Systems, issn -- 0921-0296 (Print) 1573-0409 (Online), doi -- 10.1007/s10846-009-9367-1, Springer, September 2009

Koyuncu, E., Inalhan, G., ***Dynamically Feasible Probabilistic Motion Planning in Complex Environments for Unmanned Aerial Vehicles***, Cutting Edges Robotics 2009, ed. V. Kordic, A. Lazinica and M. Merdan, ISBN978-3-902613-46-2, In-Tech Press, 2009

Koyuncu E., Yeniceri R., Ceylan O, *Computer Vision Based Artificial Neural Networks Controlled Object Tracker Intelligent Turret Design*, Turkish Military Academy, National Defense Science Research Awards 2006 Special Event journal, **Best 3rd Place Journal**, March 2006 (in Turkish)

Conference Papers

Koyuncu E., Ure, N. K., Inalhan, G*., Integration of Path/Maneuver Planning in Complex Environmentsfor Agile Maneuvering UCAVs*, Proc. 2th Int. Symposium on Unmanned Aerial Vehicles (UAV'09), Reno, Nevada, Haziran 2009

*Koyuncu, E., Inalhan, G., **A Probabilistic B-Spline Motion Planning Algorithm for Unmanned Helicopters Flying in Dense 3D Environments**, Int. Conf. Intelligent Robots and Systems (IROS'08),Nice, France, September 2008*

*Koyuncu, E., Ure, N.K., Inalhan, G., **A Probabilistic Algorithm for Mode Based Motion Planning of Agile Air Vehicles in Complex Environment**s, Int. Federation of Automatic Control World Congress (IFAC WC'08),Seoul, South Korea, June 2008*

*Turanli, M., Koyuncu, E., Inalhan, G., **Multi-Purpose Testbed Design for Mobile Autonomous Robots: ITUCAL Robotic Testbed Platform**, Turkish National Automatic Control Committee (TOK 2008), Istanbul, Turkey, September 2008 (in Turkish)*

*Koyuncu E., Demirok E., **Artificial Neural Networks Controlled Maximum Power Point Tracker for Solar Vehicles in Rapidly Changing Conditions**, Applications and Innovations in Intelligent Systems (ASYU), June 2006 (in Turkish)*

Koyuncu E., Yeniçeri R., Ceylan O., *Computer Vision Based Object Tracker Robot Arm Design*, Turkish National Automatic Control Committee (TOK 2005), Istanbul, Turkey, June 2005 (in Turkish)

Presentations, Posters and Given Talks

Koyuncu, E., Ure, K., Inalhan, G., *Exploiting Delayed and Imperfect Informations for Genrating Dynamically Feasible Pursuer Strategy in Complex Environments*, Int. Conf. on Dynamics of Informations and Systems 2010, Florida, February 2010

Koyuncu, E., Inalhan, G., *Probabilistic Trajectory Planning for Air Vehicles Flying in Complex Environments*, *Control of Multi-Agent and Multi-Communicated Dynamical Systems Workshop, TOBB ETU, Ankara, July 2008*

Ure, N.K., Koyuncu, E., Inalhan, G., *A Mode-Based Hybrid Controller Design for Agile Maneuvering UAVs*, Int. Conf. on Cooperative Control and Optimization (CCO'08), Florida, February 2008

Koyuncu, E., Ure, N.K., Inalhan, G., *A Probabilistic Algorithm for Mode Based Motion Planning of Agile Air Vehicles in Complex Environments*, Algorithmic Motion Planning for Autonomous Robots in Challenging Environments Workshop in IROS'07, San Diego, October 2007

Dissertations

Koyuncu, E., *Probabilistic Motion Planning for Unmanned Aerial Vehicles Flying in Complex Environments*, *M.Sc. Mechatronic Engineering Dissertation under advising: Prof. Gokhan Inalhan, Mechatronic Engineering, Controls & Avionics Laboratory, Istanbul Technical University, May 2008*

Vision Based Object Orbital Tracker Robot Arm Design, Koyuncu E., B.Sc. Electrical Engineering Dissertation, *under advising: Prof. Hakan Temeltas, Robotics Laboratory, Istanbul Technical University, June 2005*

References

Prof. Gokhan Inalhan (Ph.D Stanford U., 2004)
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