Integrating engaging research project in education

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Introduction

• Institution
  • University of Pécs, Pollack Mihály Faculty of Engineering and Information technology
• Our Degree Programs
• Departments

• Main Projects
  • Orca Project
  • Embedded computers
  • Image Processing based project
  • Drone controlling systems

• Education
  • Projects in education

• Conclusion
Introduction

- University of Pécs
  - 10 Faculties
  - ~ 22000 Students
- Pollack Mihály Faculty of Engineering and Information Technology
  - 8 BSc and 9 MSc program
    - Engineering Information Technologist (BSc-MSc)
    - Architectural Designer (BA-MA)
    - Architectural Engineer (BSc)
    - Civil Engineer (BSc)
    - Electrical and Computer Engineering (BSc)
    - Environmental Engineer (BSc)
    - Industrial Engineer (BSc)
    - Mechanical Engineer (BSc)
    - Architect (MSc)
    - Architecture in Construction Design (MSc)
    - Engineering Teacher (M.Ed – MA)
    - Interior Designer (MA)
    - Structural Engineer (MSc)
    - Urban System Engineer (MSc)
Information technology

• Department of System and Software Technology
  (head: Dr. Péter Iványi)
  • Programming (C++, C#, Java)
  • Networks
  • Databases
  • CUDA Academy
  • …

• Department of Information Technology
  (head: Dr. Géza Várady)
  • Control Technology
  • Intelligent Systems
  • Robotics
  • LabVIEW Academy

• Staff
  • 16 lecturer (IT departments)
  • Several external lecturers (companies, other faculties)
ORCA project

• ORCA car – design by students
  • Fuel Cell car
  • Shell Eco Marathon (7th place in category, 2014)
  • Fully designed and built by students (Lead: István Háber)
Embedded computers

- Raspberry Pi, Jetson TK1
- Cheap and small size
- Lots of development platforms
- C++, Python, OpenCV
- Using sensors for counting passengers
Image processing projects

• Eye tracking projects
  • SmartCam, HD webcam
  • LabView + Vision

• Identifying ragweed
  • Visible range
  • SURF algorithm
  • OpenCV, Matlab

• Drone controlling systems
  • C#, LabView, OpenModelica
  • Edge and Object detection
Drone Project

- Parrot Ar.Drone 2.0
- Remote Controlled „toy”
  - Wi-Fi communication
  - Streamed HD Ready video
  - Motion and ultrasonic sensors
  - Possible control from PC
Drone dynamics

• Quadcopters
• Helicopter like
  • Hovering
• 4 rotors balances
  • Good positioning in 3D space
  • Predefined manoeuvres
    • E.g.: Flip (manually almost impossible)
• SW layer documentation
  • Possible own control software
• Control layer
  • Pitch
  • Roll
  • Yaw
  • Altitude
Drone Related Projects

- **Ragweed detection** (working with other group)
  - Flights outdoor
  - Real-time detection of specific plants

- **Real-time diagnostic proxy**
  - Getting diagnostic data from drone
  - Real-time intervention (Zsolt Schäffer, PMMIK PTE)

- **Drone controlled by HMI system**
  - Following special targets
  - Focusing with eye tracking
  - Fuse of our working LabVIEW based eye tracking system with our drone control framework (Péter Müller, PMMIK PTE)
Drone control – image processing

Pattern matching method
• Creating pattern
• Find pupil pattern
• Region of Interest (ROIs)

Circle finding method
• The pupil centre points
• Coordinates for controlling
Drone controlling

Drone Init.
- Protocols
  - TCP/IP and UDP
  - Video data
- Send AT command
  - Take off: AF*REF=290718208
- Get coordinates
  - Given by pupil searching method

Control
- Parameters
  - Flight mode
  - Max altitude
  - Speed limit

Close
- Close session
  - According to standards
Courses involved

• **Connection between project and teaching material**

• **Control Technique**
  Drone object tracking control
  ELVIS II One-degree rotor control

• **Visual Programming**
  LabVIEW programming of
  - Drone
  - Eye tracking system
  ...

• **Student Project**
  Preparing of thesis
  Working on Department Projects
  - Drone programing
  - Raspberry Pi lab
  - ELVIS II programming
  - NXT Lego programming
Conclusion

- Attractive projects
- Own projects for students
- Competition, College for Advanced Studies
- Interesting practical applications of theoretical knowledge/studies
- Motivating possibilities for various directions (control engineering, programming, image processing, etc.) during studies
Thank you for your attention!

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