Embedded Systems Programming

Student Projects
spring 2015
Hardware

Projects can be implemented on the following platforms:

- Intel Galileo - Yocto
- Intel Galileo - Debian
- Raspberry PI - Raspbian
- Intel x86 - QNX Neutrino
Cloud-ready temperature measurement system with adaptive filtering
The data measured with temperature sensor may be subject to noise-like distortions. For noise reduction the adaptive Kalman filtration can be applied.
The goal of the project is to design and develop a system performing:
- measurement of the temperature
  - communication with the cloud (Google Spreadsheet, Intel Cloud). Data storage and visualization.
  - Kalman filtering of measurement data
  - system tests

**Programming Language:** Python and C/C++
**Hardware platform:** Intel Galileo or Rasberry Pi
Tracking a moving object with two-dimensional Kalman filter

The measurement signals in navigation systems may be subject to noise-like distortions. For noise reduction the adaptive Kalman filtration can be applied.

The goal of the project is to design and develop a system performing:

▶ simulation of object movement in 2D space
  ▶ Kalman filtering of parameters of object movement (trajectory, velocity)
  ▶ communication with the cloud (Google Spreadsheet, Intel Cloud). Data storage and visualization.
  ▶ system tests

**Programming Language:** Python and C/C++

**Hardware platform:** Intel Galileo or Rasberry Pi
Project proposals (3)

System for estimation of wireless communication channel impulse response
The signal transmitted in wireless communication channel is distorted due to multipath propagation phenomenon. The multipath propagation is seen in the impulse response of the channel as in Fig. 1. For estimation of such impulse response the adaptive filtering can be applied.

Figure: Impulse response model of wireless communication channel
The goal of the project is to design and develop a system performing:

- simulation of wireless communication channel
- adaptive filtering for impulse response estimation
- communication with the cloud (Google Spreadsheet, Intel Cloud). Data storage and visualization.
- system tests

**Programming Language:** Python and C/C++

**Hardware platform:** Intel Galileo or Rasberry Pi
Collision Warning system in the Gulf of Gdansk.
The goal of the Universal Shipborne Automatic Identification System (AIS) is an automatic transmission, the ship - ship and ship - shore - ship, information on the vessels. The information is transmitted with text-based protocol. It can be used to increase safety of navigation at the sea. An example of AIS message:

```
MMSI, Name, IMO, latitude, longitude, Time
210900000, NORDPORT, 9404144, 54.55804062, 18.82849693, 01/01/2013 02:38:30
```

The goal of the project is to design and develop a system performing:

- analysis of information received from the AIS transponder (or read from text file).
- detection of vessels in the defined area
- detection of high risk of collision incidents
- communication with the cloud (Google Spreadsheet, Intel Cloud). Data storage and visualization.
- system tests

**Programming Language:** Python and C/C++  
**Hardware platform:** Intel Galileo or Rasberry Pi
Noise monitoring system
The goal of the project is to design and develop a system performing:

- measurement of noise level in different premises
- Spectral analysis of recorded signals
- communication with the cloud (Google Spreadsheet, Intel Cloud). Data storage and visualization.
- system tests

Programming Language: Python and C/C++
Hardware platform: Intel Galileo or Rasberry Pi
Smart volume control for music playback
The goal of the project is to design and develop a system of matching the volume of music listened through headphones or loudspeaker for measured ambient noise. Main tasks of the project are:

- measurement of noise level in the listener’s surroundings
- matching the volume of music played on the headphones or loudspeaker to measured noise level
- system tests

**Programming Language:** Python and C/C++

**Hardware platform:** Intel Galileo or Rasberry Pi
Smart storage of chemicals
The goal of the project is to design and develop a system for managing the storage of chemicals, with a limited storage positions, in which only certain products can be stored next to each other. Main tasks of the project are:

▶ upload the list of chemicals and its interactions from a remote database or cloud
▶ assign each chemical substance storage position
▶ send the map of substance allocation to a remote database or cloud.
▶ system tests.

Programming Language: Python and C/C++
Hardware platform: Intel Galileo or Rasberry Pi
1. Raspberry PI audio server for playback streams from the mixer and client applications.
2. Smart video monitoring system (over Ethernet) on Raspberry PI platform.
3. Smart audio monitoring system (over ethernet) on Raspberry PI platform.
4. GIT server to remote application management and monitoring state server (optional HW platform).
5. Driver for a device other than RS-232 (optional HW platform).
Project proposals (13-16)

1. Web server with database service (optional HW platform).
2. Alphanumeric LED display control system (optional HW platform).
4. System for monitoring the power consumption of external devices. The system should consist of Intel Galileo or Raspberry Pi platform and PC computer.