PAHIMA pametna hiša Malina

Aleksandar Tošić[1], Dean Cerin[1], Jaša Bartelj[3], Nejc Radež[2], Primož Lukunič[5], Sašo Cuder[4,5], Tadej Krivec[2], Tanja Štular[1], Vladan Jovičić[1], Andrej Brodnik[1,3]

[1] *University of Primorska, Faculty of Mathematics, Natural Sciences and Information Technology*

[2] *University of Ljubljana, Faculty of Electrical Engineering*

[3] *University of Ljubljana, Faculty of Computer and Information Science*

[4] *A-ROSSO*

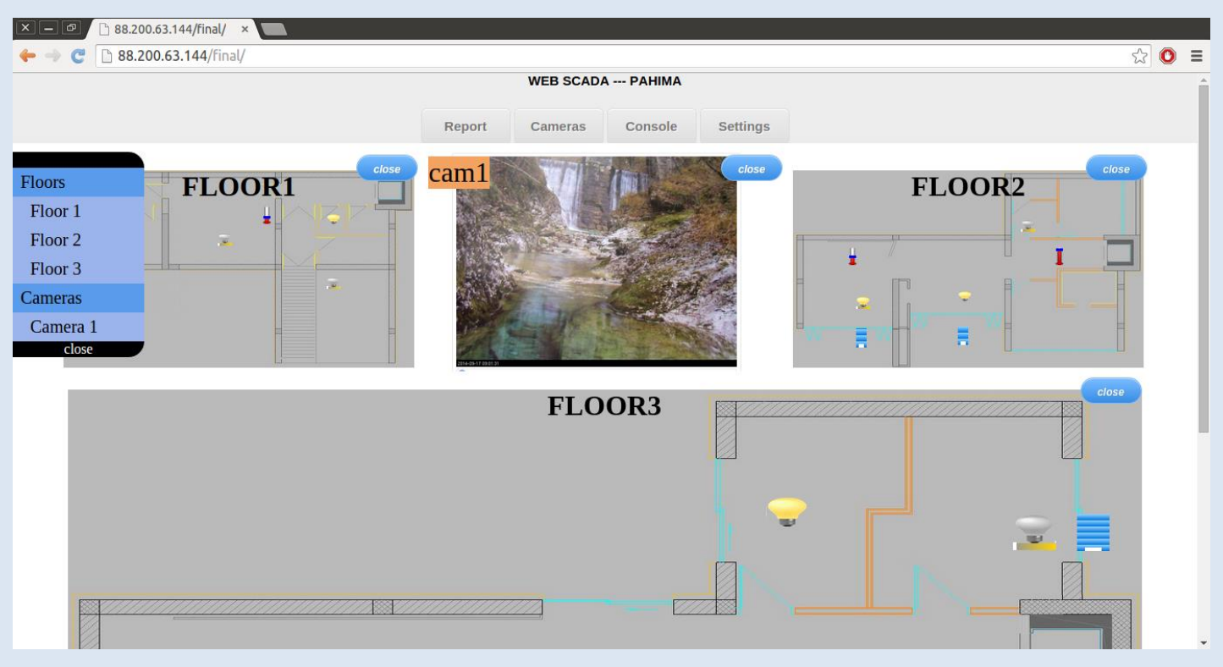
[5] *PRODATA*

Graphical User Interface:

For controlling modules we built a SCADA (supervisory control and data acquisition) system, implemented through a web application, which connects all modules and enables interaction between them. One of the main tasks of a SCADA system is to control electrical devices such as lights, blinds or temperature. Thus, we had to design all these elements to enable user to have full control of their house.

The simplest element is lighting. In their simplest form, lights have only two states: on and off. Clicking on this element, its state is changed. However, Dali lights have have controllable brightness levels. For these lights, a slider was created which sets the opacity of one of the light element images and also sets value of this element.

Temperature is more complicated since it has value between 0-100 . A simple thermometer is drawn with draggable indicator line overlay. By dragging the line on the thermometer value between 0-100 is chosen. For blinds we had to enable setting the position and state of the blinds: opened or closed. There is line on this element, which is draggable and used for setting position. By clicking on the element, the user can change whether the blinds are opened or closed. When the user opens the web application, a "settings" dialog is shown where user can easily add panels (iframes) to the view area. Each panel can be either floor or camera.



Acknowledgment:

Projekt delno financira Evropska unija, in sicer iz Evropskega socialnega sklada. Projekt se izvaja v okviru Operativnega programa razvoja človeških virov za obdobje 2007–2013, 1. razvojne prioritete »Spodbujanje podjetništva in prilagodljivosti« ter prednostne usmeritve 1.3. »Štipendijske sheme«, v okviru potrjene operacije »Po kreativni poti do praktičnega znanja«.

REPUBLIKA SLOVENIJA
MINISTRSTVO ZA IZOBRAŽEVANJE, ZNANOST IN ŠPORT

Naložba v vašo prihodnost
OPERACIJO DELNO FINANCIRA EVROPSKA UNIJA
Evropski sklad za regionalni razvoj
Kohezijski sklad
Evropski socialni sklad

Project Rationale:

Modern houses are from from simple walls with windows and doors in which we spend our time. In order to achieve energy efficiency, security and comfort, houses take advantage of a variety of IT controlled devices. Traditionally these devices were controlled by industrial micro controllers (PLC) with the devices as their periphery. Nowadays there are available, capable and cheep microcomputers that permit use of standard, open source development enviorments., which further reduces the price and improves the use. Furthermore, PLC based design did not put a lot of emphasis on security, which is easier to achieve through standard services and protocols run on computers. The result of the project was a working modular system for smart houses that is both affordable and secure.

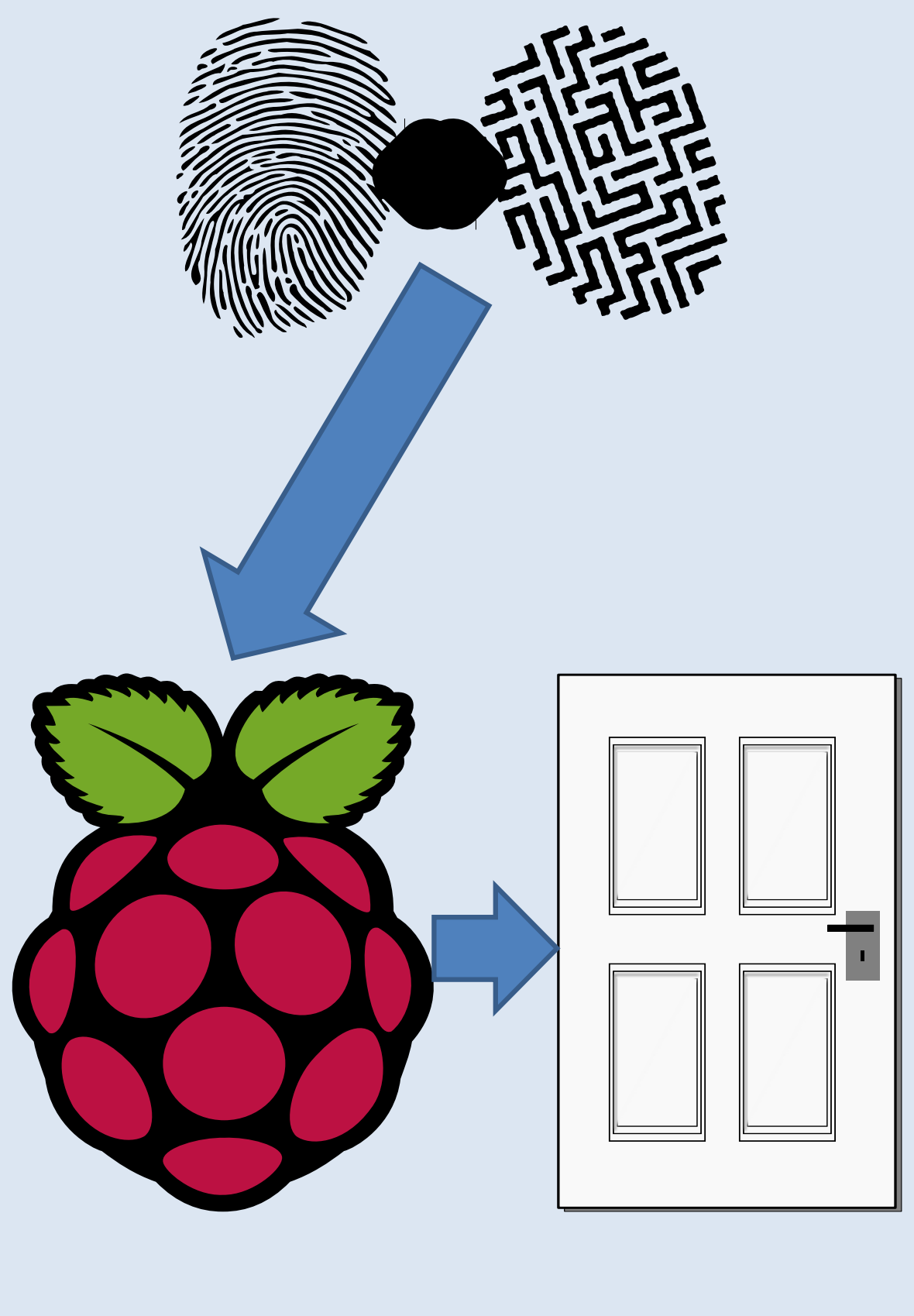
Fingerprints:

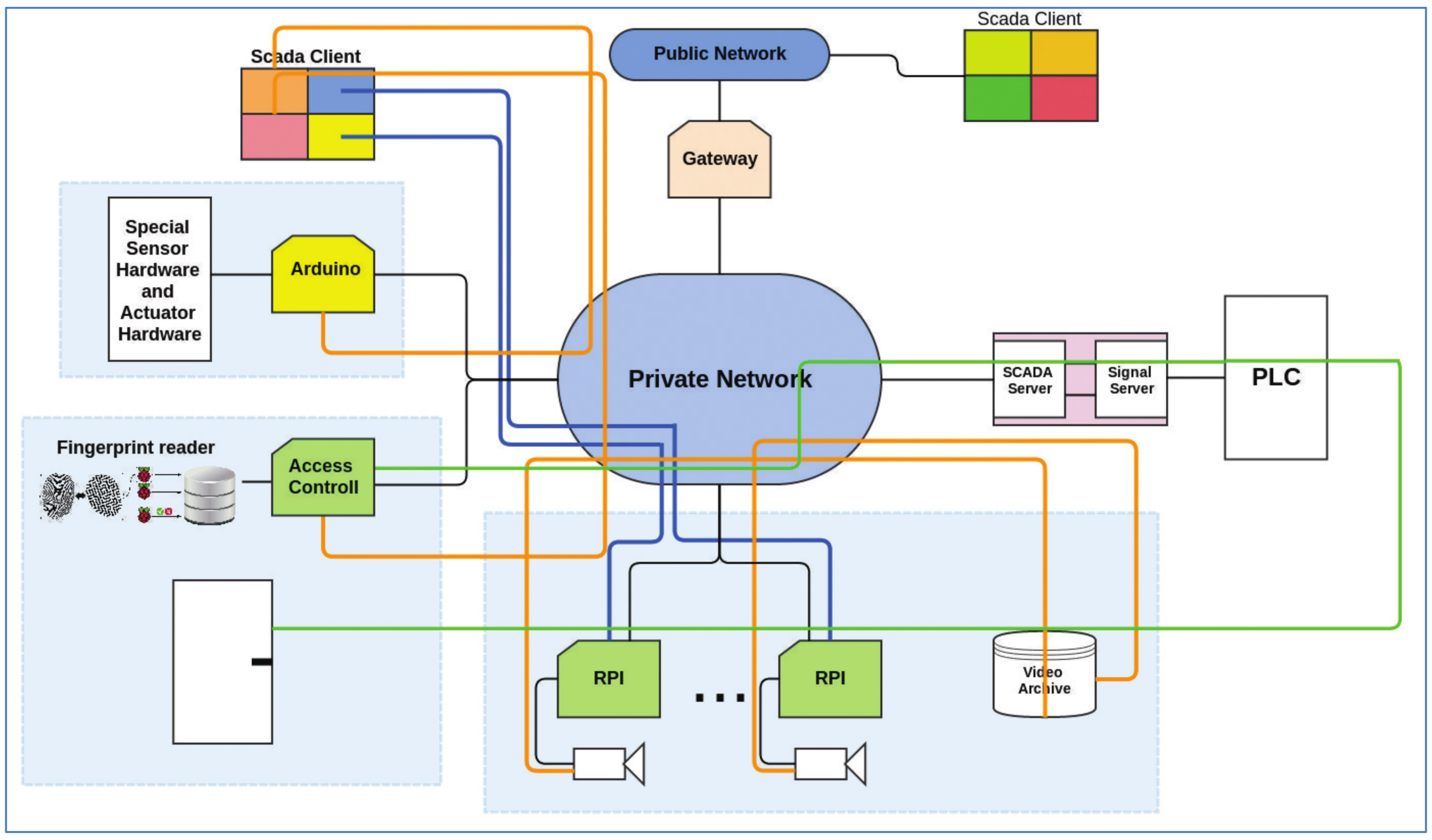
An important aspect and addition to the security of smart housing is biometric access control.

In PAHIMA a fingerprint reader is paired with a Raspberry Pi computer. This provides a rich open-source software stack used to authenticate a user and request an authorized action based on a predetermined list. Two examples are opening doors and restricting access to the SCADA system itself.

The software responsibilities on the Raspberry Pi are storing fingerprints, comparing them, publishing events and requesting actions. Some of these can be omitted based on the installed model of the fingerprint reader.

The main advantage of this approach is modularization, greater security and scalability while keeping costs down.





Partners:

UNIVERZA NA PRIMORSKEM
UNIVERSITÀ DEL LITORALE

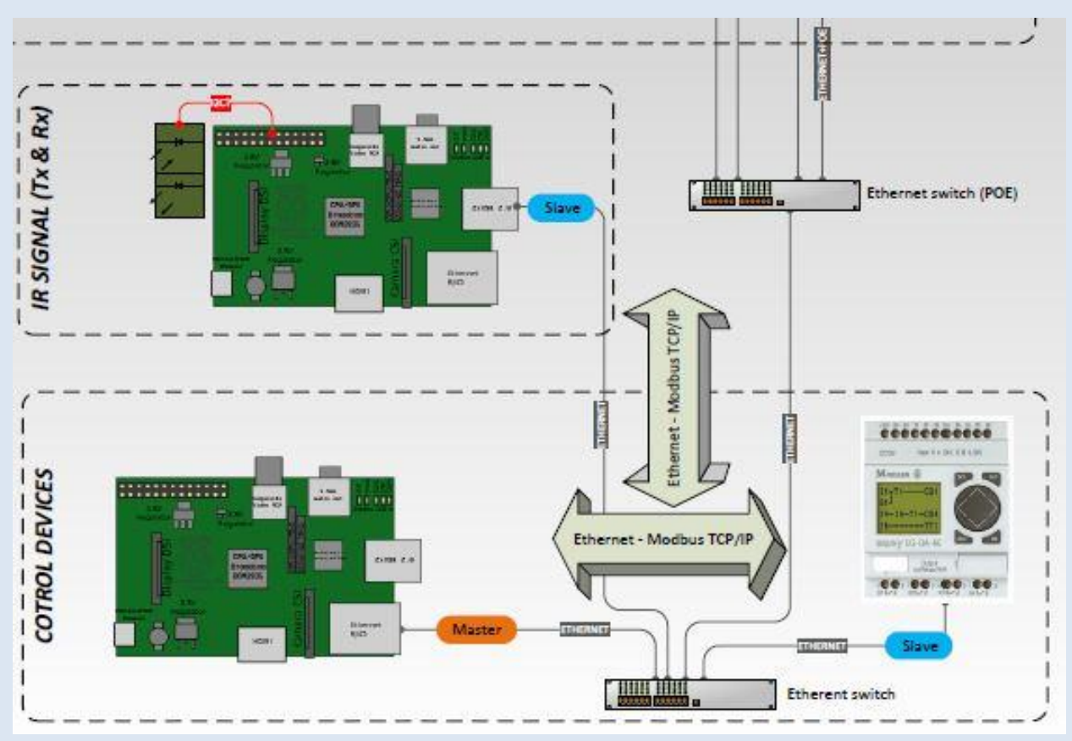
Univerza *v Ljubljani*

A-ROSSO

PRODATA

Sensors and Device Control:

We developed our own unit that we call PAHIMA unit. The intention of developing this unit is to make a simplified and more purposeful microcontroller board so it can be smaller and thinner to fit into an installation case. The size of the doses may vary from 1 to 7 switches and since this unit should be for general use, our goal is to aim for the maximum. The requirements for the unit are:



- 14 digital inputs for the connection of the double state switches
- 7 digital outputs for the connection of the signal LED (The single state switches have a possibility of installing a signal LED to know if the switch is off or on)
- Temperature and humidity sensor
- Powered over ethernet
- Communication over Modbus TCP/IP protocol

Raspberry Pi works as a Modbus TCP/IP server and is in charge of all communication over our electrical infrastructure.

Our IR module is able to record/store IR signals and control IR controlled devices like TV-s and Air conditioners.We developed a simple circuit with a LED, transistor and some resistors which is based on the Raspberry Pi microcontroller. We also added a IR receiver. For decoding and sending IR signals we used the LIRC library which is very flexible and has great built in functionality.

Video control:

The video system is another enhancement of the security system in a smart house. The system consists of multiple IP cameras and at least one Raspberry PI as their controller. Cameras connect to the system over TCP/IP and an additional wire that signals the controller in case any movement is detected. We use the signal to start recording video on a higher resolution and archiving it accordingly.

The recording stops on a given interval and lets the camera check for movement again. If no movement is detected the camera decreases resolution and the controller stops recording.

We have developed a Java based program that runs on the Raspberry PI and is responsible for the following tasks:

- Maintain a list of cameras in control and access configurations
- Listen for camera signals
- Increase resolution when movement is detected
- Start recording when movement is detected
- Archive the media consistently
- When disk is full overwrite files (FIFO)
- Video streams are served to the front end application