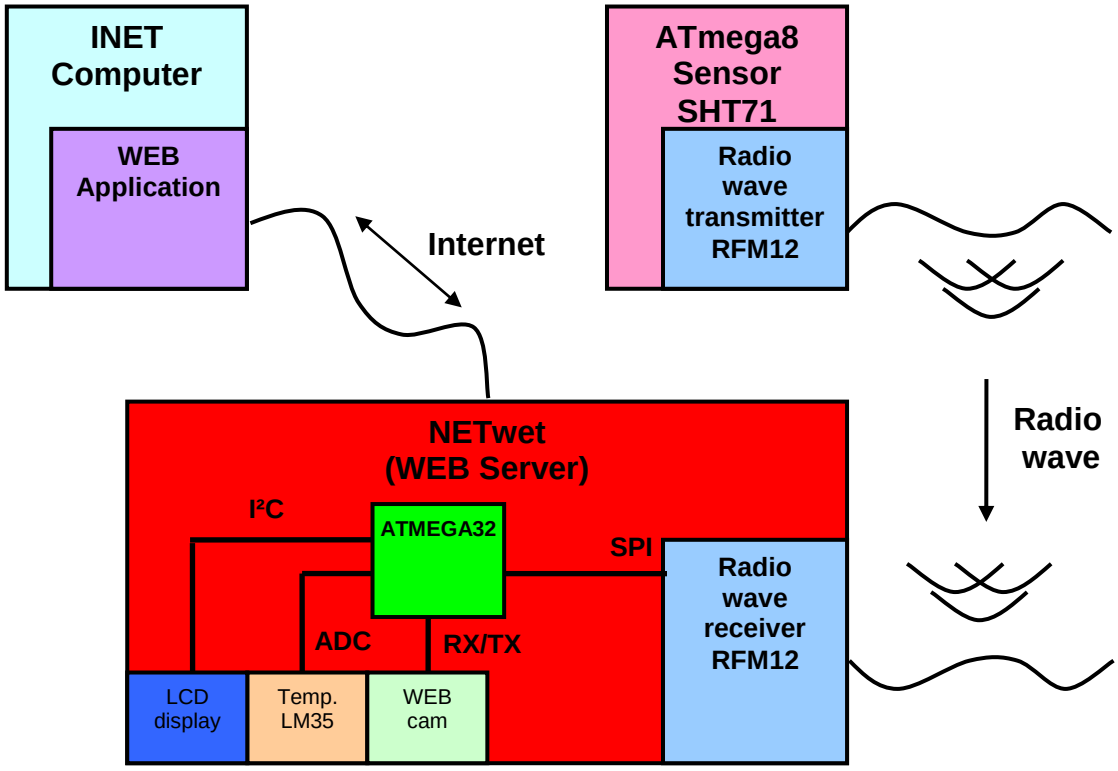
Documentation NETwet

Content

1. System overview



2. HW components web server (base)

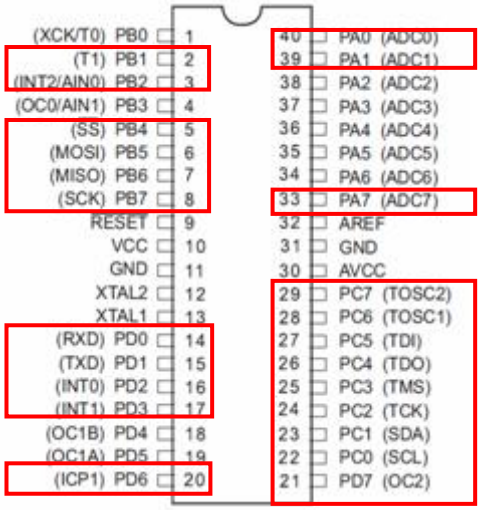
2.1. ATmega32

The RISC is used for communication with the temp. sensor, display and network controller. To be able to get pictures out of the cam, a UART crystal with a specific frequency of 7.1457MHz has to be used.

For measuring ADC values the reference on AREF is the 5V power supply, because it is the power supply for the temp. sensor LM35.

Port mapping µC:

Pin	Direction	Type	function
PA0	Input	ADC	Data signal for LM35 temp. sensor
PA7	Input	ADC	5V power supply
PA6	Input	ADC	3V power supply
PB1	Output	digital	Reset (NRESET) for ENC28J60
PB2	Input	digital	Interrupt (NINT) from ENC28J60
PB4	Output	digital	Chip select (NCS) for ENC28J60
PB5	Output	digital	Data input (MOSI) for ENC28J60
PB6	Output	digital	Data output (MISO) of ENC28J60
PB7	Output	digital	Clock signal (SCK) for SPI data transmission
PC0	Output	digital	Clock signal (SCL) for I2C display data
PC1	Output	digital	Data line (SDA) for I2C display
PC2	Output	digital	Clock signal (SCK) for RFM12
PC3	Output	digital	Chip select (CS) for RFM12
PC4	Output	digital	Data output (SDI) for RFM12
PC5	Input	digital	Data input (SDO) from RFM12
PC6	Output	digital	Reset (NRESET) for Atmega32 µC
PD0	Input	digital	Data input (RxD) from web cam MCA-25
PD1	Output	digital	Data output (TxD) for web cam MCA-25
PD2	Output	digital	Enable for web cam MCA-25
PD3	Input	digital	Interrupt (NINT) from RFM12
PD6	Output	digital	Enable for I2C display backlight
PD7	Output	digital	Enable for CAM LED lamp cluster



2.2. CAM Ericcson MCA-25

The cam is part of a mobile phone and communicates over a two wire interface with TX and RX. The cam has to be enabled over a high level at the reset pin and is supplied with nearly 3,6V.

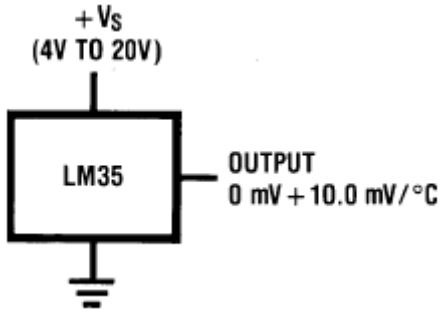
The initialization routine is a long procedure with lots of definitions for handshake and presetting, but after that, it is easy to get a picture via HTML request out of the cam and it works very fast.

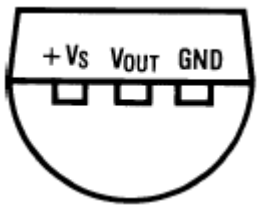
Port mapping Midas LCD:

CAM		µC
1	NC	-
2	NC	-
3	NC	-
4	Camera TX	PD0
5	Camera RX	PD1
6	NC	-
7	Enable (Hi)	PD2
8	NC	-
9	NC	-
10	GND	GND
11	Vcc (3,4-4,2 V)	5V-2*Ud

2.3. Temperature sensor LM35

The temp. Sensor is a simple three pin sensor which is connected to 5V, GND and directly to ADC0 of the µC. The temp. range starts from 0 degree up to 100 degree. With 230mV at its output the sensor measures a temperature of 23 degrees.





With an ADC reference voltage of 5V the temp could be calculated with the following formula:
Temp °C = ADC ref. voltage * ADC bit value / ADC max. bits * normalization factor e.g. 5V * 47bit / 1023bit * 100°C/V = 23°C

2.4. Network Controller ENC28J60

The network controller communicates over SPI with the µC. The power supply is 3V and the network jack is directly connected to the TX and RX pins without a transformer.
The network SW stack is available at supplier's homepage.

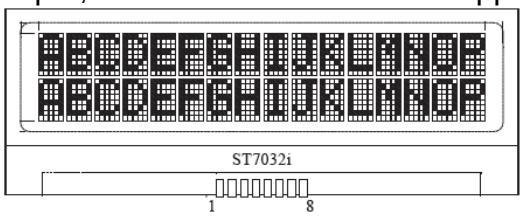
2.5. Midas I2C display

The display MCCOG21605D6W-BNMLWI is connected to the I2C pins SDA and SCL on µC pins PC1&0, but the internal TWI interface was not used for communication with the display. The initialization and transmission of the control and data bytes were done by toggling the pins manually via sbi and cbi commands.

The reset pin (8) and VIN pin (1) were connected directly to VDD. The internal display control chip ST3032i from Sitronix has its own interface protocol and a fixed slave address of 0111110(0) (7Chex).

Display pin description:

Pin	Description
1 VOUT	DC/DC for built-in booster, connected to VDD in this application
2 CAP1N	Capacitor for built-in booster, not connected in this application
3 CAP1P	Capacitor for built-in booster, not connected in this application
4 VDD	5V power supply
5 VSS	Ground
6 SDA	Data input for I2C data transmission
7 SCL	Clock input for I2C data transmission
8 NRST	Reset input, connected to VDD in this application

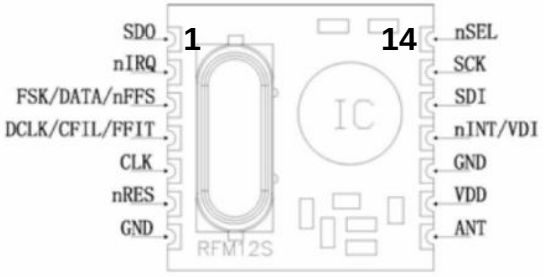


2.6. RFM12 Radio Wave Transceiver

The receiver and transmitter module will be used for short data streams between station and base module. Connection between the modules and µC is realized with a kind of SPI protocol. The module is connected to PORTC, JTAG interface has to be disabled.
Not all Pins have to be connected for the usage in this application. Important is the pull-up resistor at FSK. The antenna has a length of $\lambda/4 = 2{,}99^{8}_{m/s}/433_{Mhz}/4 = 17{,}2cm$

Port mapping µC:

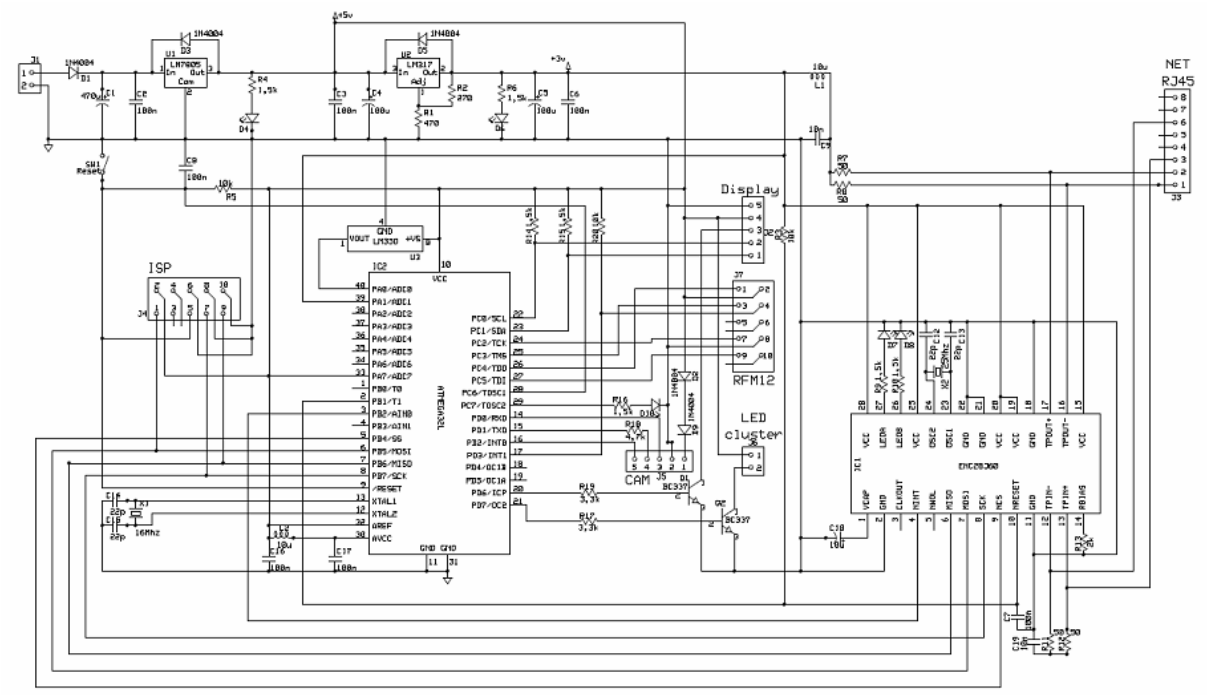
RFM12		µC
1	SDO	PC5
2	nIRQ	PD3
3	PU to VDD	-
4	NC	-
5	NC	-
6	NC	-
7	GND	-
8	ANT	-
9	VDD	-
10	GND	-
11	NC	-
12	SDI	PC4
13	SCK	PC2
14	nSEL	PC3



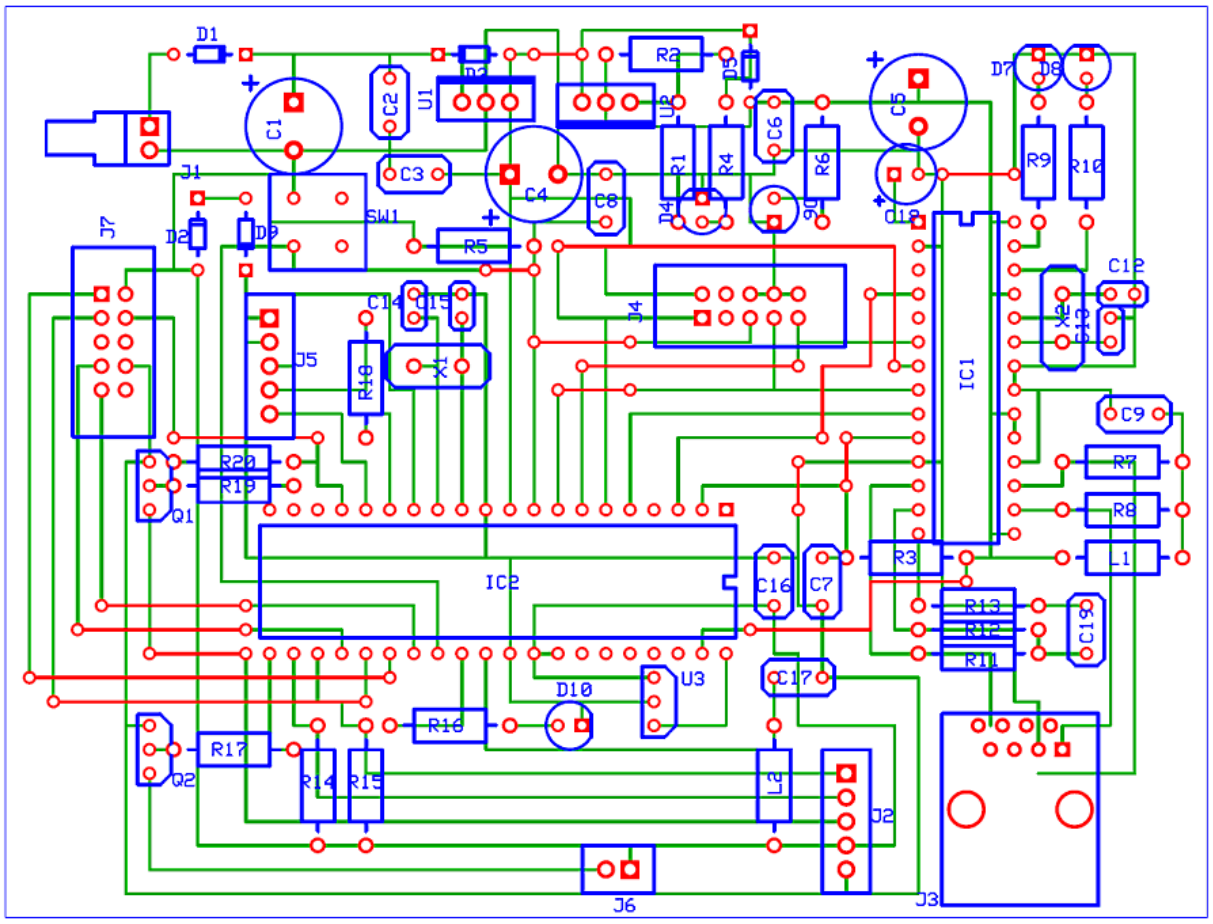
2.7. Schematic and layout (base)

Webcam and LCD display are connected via connectors to the web server board. There is no transformator or inductance necessary between the network jack and the network controller ENC28J60 when a stable network transmission is guaranteed like in small intranet network environments at home.

For the 5V power supply it is recommended to use a cooler at the voltage regulator 7805, in case of high power dissipation.



The layout fits on a euro card pcb and there is enough space for other electrical circuits.



3. HW components sensor cluster (station)

3.1. ATmega8

The RISC is used for communication with the temp. sensor, display and radio wave transceiver.

The sensor cluster sends data periodically every minute to the web server. To save energy the microcontroller is in sleep mode and only active during the sending phases.

Port mapping µC:

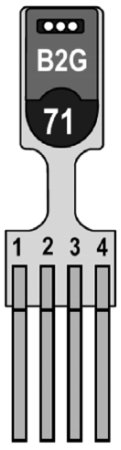
Pin	Direction	Type	function
PB2	Output	digital	Chip select (NCS) for RFM12
PB3	Output	digital	Data input (MOSI) for RFM12
PB3	Input	digital	Data output (MISO) of RFM12
PB5	Output	digital	Clock signal (SCK) for SPI data transmission
PC4	Output	digital	Data line (SDA) for I2C display
PC5	Output	digital	Clock signal (SCL) for I2C display data
PC6	Output	digital	Reset (NRESET) for Atmega8 µC
PD0	Output	digital	Clock signal (SCK) for SHT71
PD1	Input	digital	Data input (DATA) from SHT71
PD2	Input	digital	Interrupt input (INT0) for displaying data

3.2. SHT71 (temperature & humidity)

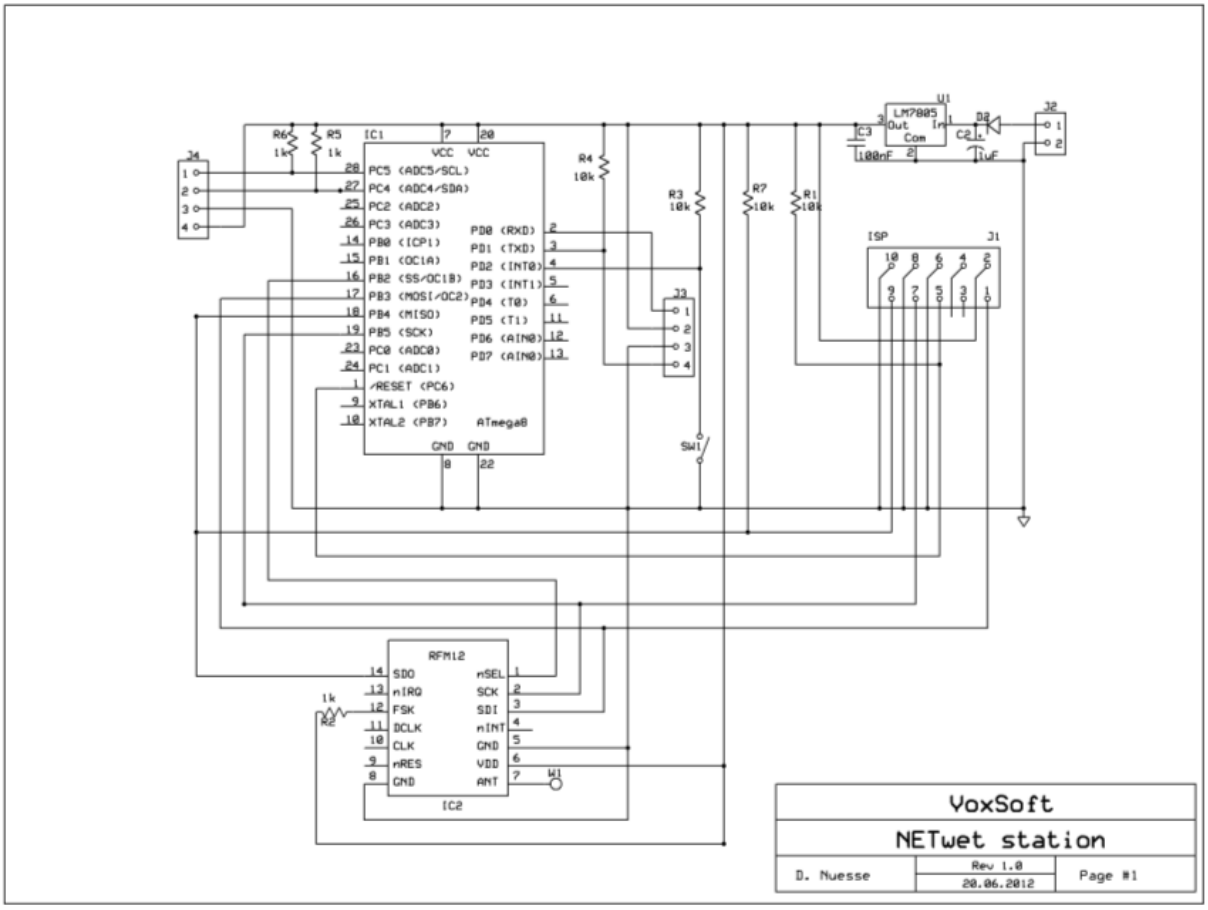
The sensor delivers the temperature and humidity data over a two wire interface, comparable to I2C.

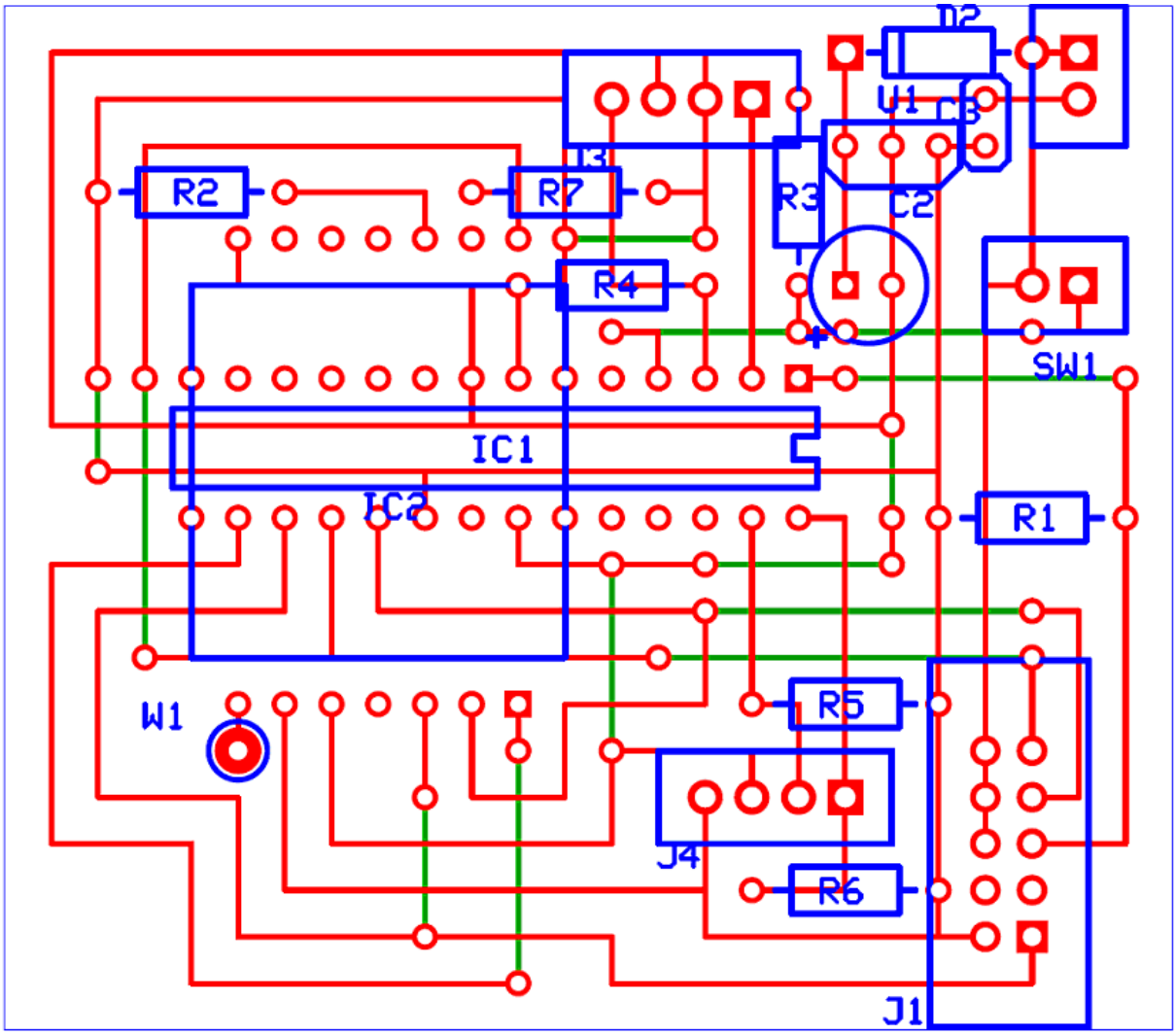
Port mapping:

SHT71		µC/Description
1	SCK	PD0
2	VDD	5V power supply
3	GND	Ground
4	DATA	PD1



3.3. Schematic and layout (station)





4. Software

4.1. Web server (base)

Basis is a source code for embedded systems which can be found in the internet by searching with phrases like “atmega web server”.

4.2. Sensor cluster (station)

The source code is a compilation of already existing program part for the display, radio wave transceiver and temperature sensor.

4.3. Camera

The cam code is also available in several projects which can be found in the www.

4.4. Temperature sensor LM35

All functions are quite simple implementations of reading in an ADC value and the calculation for the centigrade value can be found in chapter 2.3.

4.5. Temperature sensor SHT71

The manufacturer provides a code sample at the homepage.

4.6. LCD Display

In the specification there is a short description for the display initialization in assembler code, after translation into C++ and additional functions for communication the source looks like the example on the web page.

4.7. Browser pages

Enclosed some screen shots from the web page “weather”.

5. Annex