Semester Project Report

Methodes

Circuit design

Control panel PCB

We choose to have a Control panel, because a characteristic of a smart home is according to, (M. R. Alam, M. B. I. Reaz, & M. A. M. Ali, 2012) that it can be controlled remotely from outside the home.

The control panel could be developed further to be wireless with Bluetooth and controlled via an app.

For the Control panel, we choose to use buttons to navigate in a menu displayed on the LCD.

A Potentiometer was planned to control the RGB Values and the brightness of the LEDs.

We incorporated 5 buttons UP, DOWN, OK, BACK and a Button for an extra function (sleep mode).

The 4k7 Ω Resistors function as Pull up Resistors for the I2C Module of the LCD.

Main PCB

PCB

We decided to have the components in and on the house (switch-buttons, LED, Potentiometer, Sensors) wire connected to the PCB with pin header connectors. So, the PCB is detachable from the House.

We Further divided the circuit in two PCB’s. One for the Control panel, with the Buttons and Potentiometer mounted on the PCB via Through hole soldering and a pin header connection to the Liquid Crystal Display (LCD).

The other PCB has the transistor driver circuit for the LED's, circuits for the Sensors and the microcontroller on It.

3D-Modelling

We worked on a 3D-Modell for the House to 3D-print. Because the Walls have a simpler design, we decided to laser cut the Walls but print the Bottom.

(Figure1) First Version of the Walls 3D-modelled by Katharina Johannsen, that did not get printed.

Assembly of the Modell

After receiving the drilled PCBs, we checked the connections with a multimeter.

Because the PCBs had no connection errors, we continued with the next step: soldering the PCBs.

To have more space underneath the PCB when placing it on the table, we first soldered some of the pin headers to make it stand stable while soldering the vias.

Then we soldered the components starting with the flattest and ending with the tallest.

We reused the female-to-female jumper cables to create the wiring to the components in the house. So, the cables were cut in half and soldered to flex wire. (insert average length) Then the flex wires were soldered to the components according to the color-coded wiring table (Figure 2). We used shrinkable tubes to isolate the soldered wire to prevent short circuits. Now with the wiring the entire system and code could be tested.

The Control Panel PCB was mounted with 3mm screws and Xmm spacers on to the Mainboard.

Where the LEDs should go 5mm holes got drilled in the walls for the Lens to go through. To mount the LDR sensor and the PIR sensor, holes were drilled in the outer walls as well.

To arrange the LEDs, buttons and sensors in the house, it was marked where the wires go through the floor. According to that, the floor plates got holes drilled through the wood.

With the components placed on the walls, the female connectors were thread through the holes in the floor, routed at the bottom and lead to the casing of the Control Panel.

With all the connections according to the wiring table, the casing of the control panel could be closed and the walls screwed to the bottom with 2.5 x mm screws. To fixate the wires on the walls we used electrical tape.

Problems during assembly

While testing

On the Main PCB connection issues and other connection issues were discovered while testing the connections with a multimeter. We fixed the problem with resoldering the visual faulty solder joints.

We realized that D0 was just connected on top layer on the Main PCB Layout, a via was forgotten to be placed in front.

Fortunately, it was not relevant for the main functionality because it was.

Code related:

The Wire for Room 1 Button was swapped with Room 1 Pot, because the IO Pin A6 formerly assigned to Room 1 Button can only be used analog.

The Potentiometer on the control panel was not implemented because it was more convenient to code the user interface only with buttons.

The Pin D1/RX was not able to be used because it interfered with the serial communication (RX/TX), even without being connected to a PC. That was probably caused by the USB C connector circuit on the microcontroller.

D1 was originally used for button room 2 but then changed to A2.

Because J5 had just one pin connected to A2, the two wires of the buttons in parallel were soldered to one female connector.