**Ambient Student House**

*Fontys ICT & Technology – Advanced Project*

*PCT01 Group 2*

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1. **Introduction**The aim of the project is to make a modern and interactive student house – a place where students have full control over their ambient environment and are able to change and modify how they interact with the surroundings. The client’s (mentor) main requirements had to be fulfilled at all cost and the project was approached with confidence and dedication to build something that would not only satisfy, but rather impress.
2. **Background**The team behind the project consists of three students who met during the introduction phase because they were in the same class. The fact that all three are from the same country made communication significantly easier, because as we all know English proficiency among students is not a given.  
   What seemed like the biggest challenged before the beginning of the project was planning the execution. The given time period is quite short for a project of that scale and was exactly around the holidays, which made planning ahead a crucial step in order to avoid potential miscommunication and delays. Because technology is a field that is not exclusively limited to software, supplying the needed components for the build had to be done as quickly as possible without much consideration for the future. This means that the team had to stick to the hardware provided by the ISSD or already available, since shipping around the holidays is painfully slow.
3. **Problem statement**The project required many different systems to be built, including a keyed entry system moderated by a receptionist desk, an adaptive lighting system, motion-sensitive lights, customized mood lighting, a smoke detector, an air conditioner and a means of tracking the contents of the refrigerator. Considering the fact that the only means of communication between microcontrollers and PCs taught was serial communication, connecting all the systems together seemed to be the big challenge. The keyed entry system seemed like the most crucial and risky component of the system because it is not a simple and straightforward technology and is also quite unreliable and inconsistent.
4. **Process and Results**Vladimir: My part in the project was the ESP module programming, the android application and the overall project architecture. A challenging bit for me was the Bluetooth connection for the smartphone app.  
   Valentin: My contribution to the project was mostly making the Bluetooth module work as intended, since it was not what we were expecting. Also connecting the codes for everything into one code (Bluetooth, sensors, communication, etc.). C# application with the HTTP requests and python server. Minor work on the sensors. The Bluetooth microcontroller is using BLE (Bluetooth low energy) which was a challenge making it work and understanding it.  
   Ivaylo: Because of a more limited technical background compared to my groupmates, I was mostly involved with planning, communication and documentation. However, I still contributed to the technical part, making the servo motor control and the automatic mode for the AC. The most challenging part for me was getting up to speed with the team, however I learned a lot along the way.  
   The finished product is what was requested by the client, but with a little twist. All of the ambient systems created can be controlled via a smartphone application for Android. This makes interaction with the devices much more pleasant and easy at virtually no extra cost. Additionally, we added curtains to the rooms so that the students are able to control the brightness of the light in the room during the day.
5. **Conclusion and recommendations**The project has not only been fully completed, but even additional features were added to make the experience of using the product much more pleasant without increasing the costs whatsoever. We recommend that the product be installed by a specialist who knows what they’re doing. Once set up, all the systems run without any wires and are extremely easy to operate. If the project were to be extended we recommend that close attention be paid to the less reliable hardware components as they could be really unstable and possibly destroy the whole system if used incorrectly.  
   Keep in mind that the server’s IP address is hardcoded in the c# application, make sure it is correct and the Arduino is plugged in to the correct port before starting it.  
   **Bugs:** Loose wiring is the issue that causes the most problems, however it’s unavoidable with prototype systems. Be careful when transporting the product and make sure that everything is connected properly before deploying the solution. Additionally, be careful when adding items containing special characters to the refrigerator. Sometimes there’s an issue with communication and the c# application cannot always read everything properly. Emojis usually encounter this issue, so do not add fruits and vegetables with emojis, rather type out the type of food added/removed verbally.  
   The gas sensor is also something to take in mind. It is not properly calibrated, as that is quite difficult with this cheap sensor. The threshold has to be manually set for each room and a false positive alarm has also been an issue.  
   The Android application also has some issues from time to time, mainly when trying to execute tasks without having the Bluetooth connected. Make sure everything is set up properly before trying to adjust fans/curtains. Also avoid adding too much food to the fridge or trying to remove items when it is empty.
6. **Reflection**Vladimir: The project workflow went as expected. All tasks were finished in time and we even had the time to implement some additional features. In the next project we will most probably stick to the same technologies, used in this project also we will try to work more on the team communication and the project planning part. What I’m most proud of is the overall architecture of the system and the communication between its distinct modules.  
   Valentin: Everything went as expected, we found a work-around for every problem we encountered. I think if the project allows it, we'll stick again to the same technologies, since they are the fastest we could think of and are working as intended. We would consult with the project manager more. What makes me proud would be the communication between the modules and different apps. Also the fact that the "room" (the project) is not connected to any PC and it needs just power, as it should be in a real hotel room. Everything can be set up remotely.  
   Ivaylo: Overall, I would say I’m very satisfied with how the project went. Of course there were some struggles along the way that I would like to have addressed next time, I’d say for a first project it’s a massive success. I’m really proud of the system’s ability to run entirely off of wall outlet power, meaning you don’t need USB wires hanging around everywhere. For the next project we will make sure that we take a better care of the planning and documentation part, as well as continue striving to be the best.