ModulSim Smart Home Presentation Transcript - Group 4

Jon W:

Alright, hello everybody we are the ModulSim smart home group. Our members are Bianca Doronila, Clark Gumba, Christian Gonzalez and Jon Wilson. This is what we will be talking about today.

Clark G:

With the rise of smart homes, with the internet of things, where everything is connected together be that our tv, our Roombas and sometimes even our fridge. There's no doubt been a rise in smart homes in the past years now in the United States.

As we can see here in this chart, almost half of U.S. homes are considered smart homes with more being built. In 2023, 60 million homes out of 100 million homes are going to be a smart home but that begs to differ, there are a lot of people that are being left out.

Smart homes are a quality of life improvement and millions of people don't have access to this. We provide..ModulSim provides smart home services to people living in older model of homes, rental homes, mobile homes and apartments. These are people that are restricted by lease agreement, contracts with landlords or just the financial cost and the lack of time for renovations. ModulSim is really designed for those homeowners who want that smart home capability without needing to spend a fortune or have to undergo these extensive renovations in their house to modernize them. See, ModulSim is separated into different modules.

The current version has light controllers, automatic interior door controllers, automatic garage door controllers and A/C controller also with temperature and humidity sensor so our users can see and change that on the go. It's also all controlled by one ModulSim app.

Here's a little simple data flow chart just to visualize where all these modules are connected to and how they're sending data to either a phone app, a central terminal or a computer program where our users are going to be able to control everything. So, we get all that data from those different modules whether a door is closed or open or whether lights are on or off and those data are being sent back to the phone where then our users can put a command which will then send via Bluetooth back to those modules and run everything as needed.

Christian:

And now, in terms of organization of this project and pretty much our plan for this, we had to set a very organized timeline of productivity in order to successfully achieve this product. So we pretty much started out in the phase of drafting and planning how we were going to be constructing this home but in the middle of the timeline this is when we basically start actually doing the technological side of this project of programming, setting up the sensors and motors and such. And since our spring break presentation or you could say our midterm presentation we have been putting a lot of work into implementing those Bluetooth capabilities and also meeting up and combining all the technology with the home construction that we had finished prior to

that time. And as you can see based on this 16 week timeline we have actually finished pretty much perfectly with the productivity that we've been going through this whole semester.

Jon:

Alright, so as Clark had talked about a little bit, the features that we have in ModulSim are lighting that is toggleable from the smartphone app, we have automatic control through the use of A/C and we have motion-activated interior and garage doors.

Now, if you look at these relays here, this is a bank of relays, each of those circuits goes through one of the relays. So the upstairs lights go through one, the garage lights will go through one, etc.

So this is a demonstration of the scale model house, the dimensions of the house are 29.5" by 21.5" by 10.5" and all of that is mounted on an 18"x36" base plate. The scale home has 4 rooms that each have independent lighting and then in the downstair portion there is an automatic interior door. On the left you can see the automatic garage door and then up on the top is the simulated air conditioning system. Sensors and controllers can be used with the ModulSim app or the central house terminal.

Christian:

As you can see here we'll be providing a visual demo of the modules.

Jon:

So as for the app development of this program we utilized MIT's app inventor program as well as the HC-05 Bluetooth module for the Arduino and there's plenty of information available online on connecting these two. MIT app inventor was a great way to program a simple app considering our app only needed on and off switches and the ability to connect over Bluetooth we were able to accomplish that relatively easily. And we were also able to accomplish communication between the Arduino and the app relatively easily. However, that does not mean we went without plenty of tests. Because of the cost of both the bluetooth module and ease of use of the app inventor, we ran into many issues with consistent communication. So, after many tests we got it working but that was an issue we ran into consistently.

So this is just going to be a little demonstration of the app.

Christian:

And as you can see here as we've been working on the project we've had to purchase several items in order to make this become a reality. And as you can see kind of towards the bottom for the construction phase we had to buy you know our plywood sheets for constructing the house, your screws and the blade for woodcutting. And then for the technical side we've ended up using our Elegoo and Elegoo Uno Board and we used an Elegoo Mega board. Those were probably the most pricey parts of this project but these kits came with a lot of essential sensors and motors we used for this project. Everything else you see here is just our wires and extra sensors we had to buy along the way. And previously, we wanted to keep our budget below

$300 total and as you can see here we were able to maintain budget friendly as we're pretty much a little more than half of that at $174. So we did a pretty good job in maintaining a very very, low budget for this project.

Bianca:

So the challenges our group faced was mainly due to Covid from transitioning over a real house like we originally had planned for we settled for a model scale house. This is because we couldn't meet up regularly in person as needed, we did however meet up a couple of times to build our house, compile everything up and do some final testing. Next we needed to be mindful of the cost as mentioned by Christian since we didn't have a lot of the resources that was offered through the school such as fablab so we really had to watch our budget. Therefore, we needed to be both creative and efficient with our money thus leading us to our small scale smart home. All materials that were used in our house were downsized and just enough for our budget, like Christian mentioned we cut our budget cost in half. However, since most meetings and individual work and testing were done separately and online there were some resources we had to purchase multiple times like we had 3 different UNO kits so we could all work on our respective parts.

To conclude our presentation we had achieved our goals for the senior project while keeping in mind our target audience. Our current ModulSim version is both user and cost friendly. It's fully functional, individual modules working either separately or together with lots of room for improvement. Additionally our integrated app is also functional via bluetooth connection and it's durable so it can withstand our current environment that our smart home is in.

Future plans for ModulSim is to implement more features like opening and closing window blinds, door locking and unlocking operations, and to be able to monitor house cameras within the same app. Also we want our product to be more personal to our users so we would like to implement personal profiles and compatibility with other softwares. And lastly to be able to transition from Arduino to custom-made circuit boards. We want to also go back to our original project proposal which is to make affordable and user-friendly smart home so we'll have to scale it back up from a model home to a real sized smart home.

Jon:

And something we realized along the way was the ability while using relays in our circuit just how many options we would have in a smart home. So devices like lights, fans, automatic motors, those kinds of things, those could all be connected to relays which would be connected to the rest of our system. So in looking towards the future, that is definitely something we would keep in mind is using the relays to the best of their abilities to make this more marketable.

Christian:

And thank you for watching, everyone.