P1 Exit Interview

**Researcher 1** 00:02

Okay, great. Yeah. So thanks for joining us. Again, we're just following up with everybody kind of individually, really, just now we've had a chance to look, transcribe and look back at the group calls. So now we're just talking to everybody to pick up on your interesting things that we've noticed through the calls that we want to explore in a bit more detail, but also like the chance to talk to people individually and pick up on maybe some of the things that you were talking about specifically, rather than than other people and let you sort of, you know, talk a bit more about those. So thanks for joining us. And I figured just just to start off, maybe, how have you found participating in the project? How's your experience been?

**P1** 00:51

Yeah, it was, it was very interesting. Um, it sort of made me think about things that I didn't think about before, you know, just the sensors and stuff, but how people actually interact with it, and what other people like to get from it, it was quite interesting to see people, pretty much novices in terms of the electronic parts. And even IoT is such that how they perceive and enjoy or whatever the devices that they can, or the information that they can get from that

**Researcher 2** 01:35

sort of socially, in terms of the almost sort of socially with the other participants?

**P1** 01:42

Yeah, yeah, it was. Yeah, it was just totally a different point of view from mine, you know, it's always interesting to see what other people get from something. Because, yeah, I think I've found my approach to it is probably a lot more practical, you know, I can streamline this or do that, or grow chillies, because I can monitor the environment or something. But I think for most of the other participants, it was kind of a talking point, like you say, socially, or maybe just being able to see what effect them having in walking into a room would have on the environment and so on. Yeah. So, so I found that interesting. It also, what, made me think about well, so my watch, I almost always have that come with me. So that's got sensors that go all the time. What I found was with the with the Data Probe that I got from you guys, I'm really bad. I forget to take it with me. So it sits, it sits Yeah, and that's how I like it, I would prefer to have one in each room. And, you know, and then I can look at all the different things happening at the same time. So, or see how it differ. Differs. And the other thing is, I would not, I would tend not to use the web interface, which I think most of the others use. I would, it's much easier for me to take the the SD card out, but I would I would have just if it were I'd had the choice I would have made Wi Fi so I can get it from anywhere in the house. You know,

**Researcher 2** 03:51

so you would have made it you would have given it the ability to attach to a network and then

**P1** 03:57

yeah, yeah, I've done that. I've got some I mean, this one here is doing exactly that. Got a, a screen where's the camera

**Researcher 2** 04:08

slightly over to the other side of you. I think

**P1** 04:11

it's too small. The table is too short. Yeah, it's just got I 3D printed a little thing. So there's it's just got an LDR in there and a DHT11.

**P1** 04:28

Oh, yeah. The humidity one.

**P1** 04:30

Yeah. The humidity and temperature one. It's it's talking MQTT to my Raspberry Pi MQTT broker. Yeah. So I would just make everything MQTT and have it talk to the broker because then I can get it in one place. And get it from all over the house. You know, so that I don't have to carry the probe around because I'll forget, but also I I think I would like to be able to get it from every room and be able to compare it, which is why I started building these.

**Researcher 2** 05:08

Did you start building these as a result almost of this this project?

**P1** 05:12

Yes, yes, I started again, I did did it quite a few years ago. So which is why I've got a lot of equipment lying around the house. You know, all over, I play with it every now and then. But then I didn't touch it for a while. Because at that point, what I was trying to do was the way I approached, it was different and what happened, I can't remember exactly why. But they would only run for like two hours and then didn't want to work that was the 826s. But now that the ESP32s and they seem to not have that problem. They they've been running for quite a quite a while. And yeah, so picking up on it, again, was as a result of, of this, because Hang on, I want to make a similar, make something similar to these probes and put it in the other rooms. But then I want it to talk MQTT to make so I don't have to go and take SD cards out.

**Researcher 2** 06:11

How would you have felt if, Well, can you speculate maybe about how you if we had done that to start with somehow, if we had have got if the Probes was something you were supposed to put on your home network? Like, did connect to the internet or something. Do you? Do you think they would have been a good thing? Or do you think, do you have any, Would that have change the way you've... So we quite deliberately kept them offline, right. And I'm wondering if that made you feel more or less confident or like,

**P1** 06:50

no, because I know enough to know that it's not available on the internet outside. It's basically a local network. So the I mean, one of the concerns that some of the other people, or at least one of the people had words that you know, well, actually, the one time we talked, we all talked about it was about the fact that I would like this information. And I would even be happy if I used to provide it, but I'm not happy about the fact that they just want to abuse my data, you know. In this case, I know it's all in my house. It's I'm not connecting to any outside servers, what I was thinking though is to get all of them to I could potentially put it all in go and publish it somewhere where one of them will publish it to a public where I can just so at the moment, everything is published to my in house MQTT broker. And I'm not using anything external. So my data is not out there. But if I did, so like I'm going away in September, and if I wanted to monitor my house remotely, I could potentially just send a big blob of JSON on a on a external one, and I can put in there just what I want, you know, things that I wouldn't mind if, if so, if it's less secure, and if it was more secure, I'd use a VPN or something, you know, so but I've got control over it, I can pretty much control who's gonna see what, it's localised to my house, and I can [inaudible]. And so but I think it's, it's difficult if people don't understand how networking works, and how the internet works, and what, you know, it's not my phone that is connected to your public network, necessarily. Yeah, but like I said, I understand that and I can control what I make available. I do have Alexas and I do have my watch, which are connected to an app, which is connected to the internet. And so I know that is potentially open for abuse. But these probes, at least I know, I can control through my house.

**Researcher 1** 09:29

So thinking about that visualisation that you build then? Because that's, that's really interesting. I think that that, you know, you'd ideally like that to be online and web accessible, but thinking about the ones that you've built, rather than than using the one that was in there. What was it? What was it that led you to do that and that you sort of was there anything that you particularly wanted to achieve through that visualisation that you couldn't do with built in one?

**P1** 09:56

Um, yes, well The one that we were working on Yeah, I can look at specific times, you know, you can zoom in on times, you can zoom in on days, or whatever you want to do. And I could potentially, if I want look at all the data, all the sensors for a specific time, you know, I can compare the data and make, like, you guys kept asking for the story that it's telling. But to me, it's almost, yeah, I mean, if you put it all together, it will tell more of a story. You know, when you look at

**Researcher 2** 10:42

You mean lining up the days, so that you're looking across at the same time each

**P1** 10:48

If I look at it, I can see the temperature. So in this 24 hour, I can see the temperature and I can see maybe the light relates to the temperature because the sun is coming. And maybe there's more noise because I'm in the office, and I'm talking and, and you know you can see this room has been lived in. And if I put it in the lounge, it's going to be pretty much a straight line, maybe with a little bit of a dip in the evenings. Or, you know, put it in my bedroom, I can see when I go to bed because there'll be a bit of noise and maybe temperature changes. How does the temperature change during the night? I'm forever waking up with a headache and I think it's because when my head is it's it cools down during the night. And then you know, so I would be interested in see how the room temperature dips during the night. And if, if that is what why I wake up with a headache, stuff like that. But yeah, so I can like I said, if I can, I like I like to be able to view it. Like, sometimes I just want to, you know that the one that we saw, when I was on the bus going to Newcastle, I could see on the GPS where I was going and I could see all the access points that I was picking up and losing and picking up and losing. That's just telling me a story about my life. I mean, it's not going to serve any practical purpose, probably. But it's just interesting to see.

**Researcher 1** 12:25

And I mean, you've clearly been like very engaged with with sort of getting at that data and making sense of that data and finding stuff in it. And I suppose. So my question is kind of where does that? Where does that come from? I suppose that that interest in in, I think you've talked about, I think in one of the calls you made, we talked about like the idea of almost data for data's sake, you kind of just want the data, I suppose. And I wondered if you could maybe, maybe talk a bit about why you liked that so much, I suppose if that makes sense.

**P1** 13:07

Yeah. I don't know. I'm just intrigued by it. I've always had an interest in electronics. So as a child I used I would build little things, you know, like a little FM transmitter or I don't know why I just did you know, there's no specific reason I didn't necessarily want to be able to do something with it it was just I think it's I like making things. So to me, it's relaxing to make these things. It's, even though it's still computers, it's sort of a break from the work that I have to do. And even if I analyse that data, it's mine. It's my, my playground, you know, it what I, I just, like seeing the things in terms of numbers.

**Researcher 2** 14:03

Do you think? Sorry, keep going

**P1** 14:07

in terms of numbers and pretty graphs and pictures, you know?

**Researcher 2** 14:10

I was just wondering to what, Yeah, I think I've got the same thing. But also kind of wondering about what, yeah, that kind of sense of making something like, obviously, you coded up your visualisation, which was a making of something. I'm sort of also wondering whether it would be fair to say that you were sort of making the graph or make you said pretty, you know, making pretty pictures or making you think you got a sort of similar sense of do you think you did anything to put the probe in? Did you do anything to put the probe in particular circumstances or situations where it would you make a particularly nice picture or why?

**P1** 15:06

No, I didn't. But that is, I mean, I think if I, Okay, one of the problems is that the moment you give me something like this, then I've got this explosion of ideas in my mind of what you can potentially do with it. And I ended up getting distracted by all these things. So I guess if I could get myself to focus, I could try and think of what I can do with this data. Rather than how can I get more of this? I think at the moment, it's like, you know, people who make money for the sake of making money. I was, I'm kind of making data for the sake of making data and oh, look, this room did that, that room did that, that room did that. I wonder what I can make the gardens look like, you know, but not, whereas I think some people will focus just on on the one thing and say, what, you know, they will it's almost like a PhD in just this one data probe in this one position. Or, or rather than just looking at the whole thing. Yeah, so I think because I have this tendency of sort of my mind exploding with ideas, I did not so much look at how I could manipulate this one probe. I immediately started thinking, if I put one probe in every room, then I can get, I don't have to take the probe with me. Because I know also I forget to take it, you know, by the time I'm halfway to the castle, I remember oh I wanted to take the probe. I'm terrible with with that kind of thing. But yeah, I think it immediately gave me ideas of other things you can do, or

**Researcher 2** 17:05

This is a really hard question but do you think anything about the project or the probe or anything that's happened making, help that process of imagination in any way? Or do you think there's anything do you do when you first got your watch did you have experience the same, same sort of, as you say, kind of explosion of ideas? Or?

**P1** 17:34

Well to an extent, but because I can't control the watch and what the watch gives me and because it's so much more of an issue to get the data out of the watch in a format that I can do with it, I tend to use the word watch for what it's made, and not for what I can potentially make out of it. Yeah, I think. Yeah, I think with this immediately my with the data logger, the data probe, my mind went into hacker mode, you know, you've given something I remember, watching a guy once, a talk by one of these, these kind of former hacker guys. And what he said is, when you, you know, if I, if I take something like this phone, and you give it to an engineer, they will see what it is, they can see how they can improve it, how it works and stuff, like if you give it to a hacker hacker looks at this and says, I wonder what else I can make this do. And so I think with the data probe, immediately, my hacker mind came into my hacker part of the brain came into play. But whereas with, with the watch, like I say, because I don't want to go and hack my watch to pieces, I don't really have proper access to the data, because you stuck to what the app gives you. I use it for what it gives you. So I think the data logger got my thinking juices flowing much more than this the watch.

**Researcher 1** 19:16

And, I mean, what do you think it was about the probe that what made it different to the watch, I suppose? Is it is it just that you could access the data? Or is it the fact that you know, you could see the electronics and it sort of looks like a tinker project or [inaudible]?

**P1** 19:34

Yeah, I think a little bit of everything. Um, it's, I mean, it's the fact that I can get the data out of there. And the fact that I could actually make something similar to this and I can make it part of something bigger or I can just copy what you've got there, you know? I mean, that's basically what I was trying, working or working towards with these ESPs. I was gonna ask you, your movement sensor, I think it's a SparkFun one. And I was wondering where you got them from that didn't cost a fortune, for instance, because I want to put it in, in I would like to kind of copy what you've done there, but I know I can because I've got the know how and the stuffs not that expensive. And so

**Researcher 2** 20:37

But you just to retrack a little bit, then you could see that it's the SparkFun one because it was on because you can see it right?

**P1** 20:45

Yeah, yeah. The components by now I know, shopped around and I recognise the red boards.

**Researcher 2** 20:53

I think it's like about 10 pounds aren't they? I think those ones they were relatively expensive, but

**P1** 21:03

they were really well compared to everything else, you know. The DHT11s or all these things will be a couple of pounds. You know?

**Researcher 2** 21:18

What have you go there sorry?

**P1** 21:19

It's a moisture, moisture sensor.

**Researcher 2** 21:23

Oh okay, the capacitive one?

**P1** 21:25

Yeah the capacitive of one because I have some other resistance ones, but they corrode away too quickly. I got some capacitive ones ones. And a put one there in the window in my chilli because I keep forgetting to water it. So I put one in there and I want to now put an alarm on it so that when it gets to a certain threshold, it will start screaming at me. And yeah, oh on that window sill behind me I've got a little I bought one of these these little growth lamp things, you know, with the pods from from Lidl. And you can use it for like little aquaponics. Or you can put him in soil and stuff. And then it's got a timer lamp on it. And I'll probably want to put some sensors over there too for light and humidity and maybe measure the amount of water in the reservoir. So because when I go away, [my son]'s gonna forget, but if he's got something buzzing hopefully... or at least I can send myself a message and then tell him to do this because this one's empty.

**Researcher 2** 22:43

Hypothetically if we'd given you access to the, because you've got you've got experience with Arduino you, you can see that it's an ESP module on that board. Hypothetically, if we'd given you access to that GitHub, like code repository, like, as part of this project, do you think do you think you would have kind of really like ignited your hacker...?

**P1** 23:12

I might have I think the main thing would have been time, when I'll have time to. But I think potentially I would I would have been interested in. I don't know what. I'll know when I see it.

**Researcher 2** 23:28

Yeah, I suppose drawing the graphs is sort of a relatively you can you can kind of know when you're done, right? It feels you just thinking about, you know, when you thought about that you kind of realised probably would take some time, but not not weeks of your time. Because, you know, you know how to get data out stuff, and you know, how to graph it.

**P1** 23:56

Yeah, and what also happened with with the graph stuff is, I thought, Oh, this would be nice. I just need something to convert the data into, you know, because you got these lines, you got to have that I just wrote a bash script to add square brackets in the beginning,

**Researcher 2** 24:15

Oh you made a proper because its not a proper JSON file at the moment so you might get a proper

**P1** 24:20

And then [my son], well, then what happened was, I didn't have time at the time. So I said to [my son], do you fancy writing something to visualise this data? And he said, Yes, well, he would like to learn R so he's gonna do it in R and I said, you're okay, then you can also look at R Shiny because then you can make a nice web based dashboard. So it sort of just happened to happen at the right time for for him to want to learn R, for you to give me the probe and I wanted to see the data in graph form and be able to compare it so Yeah. So I think it depends on what happens at that time. But so if I have access to data and I maybe want to learn a new language or something, that's a really good way of doing that. So in this case, it was a bit, literally a little bit of everything. But then also, as you said, that kind of got me thinking, again, about the Arduinos are not as good as the ESPs and the circuits that I had before. And I think because I started talking about that, that's when they asked me while I'm in South Africa, why don't I run this Arduino workshop for IoT is for IoT workshop, because we're gonna keep it the electronics very simple. I'll use some of these three wire sensors, which is literally just plug and play, and then I'm going to take an MQTT make and MQTT server with the Pi which I take along and just have them then using a client to there's a very simple client, you might know it MQTT explorer?

**Researcher 2** 26:12

Oh, I haven't. Yeah, I know of it. I didn't use it myself. I should have done in retrospect, I should have done. But it lets you sort of filter different message channels and they're called topics, right?

**P1** 26:31

Can you see my screen? Are you seeing the right screen? What are you seeing?

**Researcher 2** 26:41

Oh, it's got two graphs in the bottom left and a bit graph on the right.

**P1** 26:46

That's right. Yeah. So what I've got here is, there's my Raspberry Pi. It's called parrot. And there's my Astro Pi. It's another Pi. And there's Astro Pi has one of these sense hats on it, which is a bit useless. But anyway, because the temperature, the temperature thing sits right on top of the CPU. So it's, it gets really hot, it's not really accurate. But I created this JSON structure that it will publish plus some just a raw temperature structure. And then this parrot, which is my MQTT server, and it's got one of these temperature probes on these ones that you can stick in the water. So I also had the two versions, either raw or JSON format that I'm publishing there. And then I've got two ESPs. So the ESPs and these are the MAC addresses, so I know which one is which. And this one, it's got the capacitive capacitor, soil, sensor on it. So that's it. So what you can do is, I never know where to click, there we go. If click on that, you can see the the moisture sensor there and on this one, I've got a DHT22 and an LDR. So there you can see is this the light? This doesn't look right, it looks exactly the same as the previous block. That's gonna be right. And yes, the light. There we go. So yeah, so it's very simple. Unfortunately, I haven't been able to find a way of capturing the data to a file, it just plots it. You can save one, you can save one reading like that, save all the readings.

**P1** 28:34

Yeah a log of everything that's

**P1** 28:53

A few years ago, actually, I wrote something, I just want to stop this screen share. I wrote a little desktop application, which I don't know if it is, I know it's running on my other machine, which is written in Java and its just an MQTT client. I think you can subscribe and publish on it. And then I have little widgets, which is like the raw thermometer and then publish the stuff, humidity or the temperature or whatever. And then I've got one that's a data logger, that'll actually log this stuff to a file and you configure the, the thing in JSON. So you tell it which widget you want, where does what the broker is and so on. And that was nice because it just gives you all these little blocks with the different readings that you can take from wherever it is and I wanted something with a dashboard that's all in one place.

**Researcher 2** 30:05

One more question that sort of vein. I'm just wondering about the, so a lot of the things we were talking about are quite like temperature sensors, light sensors, or like moisture sensors. Just one and they're all sort of sort of roughly around the home in some way or other, as you say, you quite like the sensors to be in rooms, like, somewhere, you're not not moving them around. It's maybe a silly question. But I'm wondering if you hypothetically, you know, if you could have one sensor that you didn't have right now, what would it be kind of any sort of dream sensor or piece of data that you would like, or not?

**P1** 30:46

I don't think something specific, I think, if I could get one of these modules with several sensors on them, that would be nice. And yeah, so because this, this probe is quite big. And like I say, difficult for me, first of all, to remember, but also, because it's quite big to carry around, it would have been nice to have sort of in a wrist kind of watch thing, the motion sensor and the GPS, because then I would put on my arm and just take it along and see what that tells me. But also, again, just for the sake of it, you know, I like the other one, I could see Yeah, I travelled through Newcastle and I picked up these access points. And if I if it's portable, I would like something that has the data probe and the movement sensor on too. If it's just something that I'm gonna be using around the house, I'm probably like, sort of one thing with multiple sensors like that. The hack for the Pi, the what did I call it? Sense Hat? I think it was called. But that one is silly, because it fits right on top of the CPU, like I said, so it doesn't give you accurate reading.

**P1** 31:01

So thinking about the data, then was was there anything in there that surprised you? Or that you found like particularly interesting?

**P1** 32:10

No, I think I was just quite intrigued by the access points, you know, which access points it picks up. And I would have, I might actually go and check it at some stage. But I would like to see, because I would like to see the strength of my router that I use. Because sometimes the internet slows down terribly, you know, for us, and I don't know if it's the ISP, or whether it's the router, or whether it's where we are in the house, or something I get so that I would probably be able to use for something practical to try and determine that, but I haven't really had the time to play with that And and I think that's also why why I like the idea of a dashboard, publishing it, you know, to MQTT server with a dashboard like this MQTT Explorer thing, because I can just look at that every now and then I don't have to spend a lot of time to get to the information. Whereas the moment I need to take it off, you know, off the SD card, and then import it into the Shiny app and so on. Yeah, I think, yeah, that's, that's what I would ideally do.

**Researcher 1** 33:52

What was it about those access points that you found that you found interesting or that leapt out at you?

**P1** 34:00

I think there's one thing was how many there are. The other thing that I want to do, that I've always questioned is whether the, the the Wi Fi on the bus works. So I would like to actually see how many days there is actually Wi Fi on the bus because they tell you there's Wi Fi but I've sometimes not even been able to charge because the USB ports are just not switched on, or I've never been able to successfully use the Wi Fi on the bus. And I think I would just like to be able to see how effective or useful at all it is because I found it not very useful.

**Researcher 2** 34:44

It reminders me of you talking before about think you were talking about bus locations, or there was a conversation about essentially how you might be able to use your data to sort of talk to organisations about their, yeah, their service or their, do you remember that?

**P1** 35:10

That might have been me complaining about the Wi Fi on the bus because they advertise you'll have Wi Fi, and then I just can't connect to it or just isn't there, you know. And if you have something like that you could prove then you can say, you can tweet it. Either don't say you have it or fix it.

**Researcher 1** 35:30

There was also the lost phone, I suppose wasn't there. And that sort of sense of of,

**P1** 35:35

Yeah, the phone, which I was able to track until it and the bus disappeared and wasn't able to do anything about it. Because the company was just not responding, you know, they were just not there to do anything about it, I haven't actually really taken that up, I still want to make a big fuss with... there's nothing's gonna come from it, except that I'm gonna complain, and rant, and that's gonna make me feel better.

**Researcher 1** 36:10

I suppose I suspect I know the answer to this, because I'm asking all the participants this question, but but is there anything that you've seen in the data or experienced during the project that's changed the way you feel about a particular technology? Or, you know, sort of shown you something you you haven't appreciated about a technology or previously?

**P1** 36:40

No, I, well, I don't think I think it just kind of proves to me what I think is that there's so much more that we can do, if we if we use it appropriately and properly. And I think a lot of implementations of many of these things are just token implementations, if you know what they like, like the Wi Fi on the bus, they stick Wi Fi on the bus, just so they can say we've got Wi Fi on the bus, but in actual fact, it's totally useless. Because it's implementation is so bad for whatever reason, you know. And there are things that that we can do to make our lives or even accessibility for people who don't have it, make it so much better, by using these things properly. I can't think of something specific now. But, you know, I'm sure there will be ways that we can use it to make things more efficient, and so on. But I think too much of it, because there's so much ignorance about what these things can do and what and what not that it's not being used properly. You know, the big powers in the world that make the decision, what they make decisions about things they don't have a clue about. And, you know, I remember one time complaining about complaining to a company, because I think they said it took like, three or five days to respond to an email. And I wrote back to them and said, You realise it takes what was it? Three minutes or eight minutes for a signal to get from here to Mars, but you want to take five days to answer my email. And, yeah, so I think yeah, awareness of what it can do, and not just spreading a paranoia that people might have. And yeah, but it's always difficult. I know it's difficult to to educate people in something that's not necessarily their interest. So you get Facebook and Google and Amazon being targeted because they can listen in on your conversations. And then everybody forgets about the good that it can do.. what's the you throw the baby out with the bathwater?

**Researcher 2** 39:11

This is possibly a weird question again, I'm afraid but I'm really suddenly curious if you've got any, like favourite film or book or like, sci fi kind of like, do you think about this in terms of any sort of, sort of future vision or or you or not so much.

**Researcher 2** 39:37

I told you it's a weird question.

**P1** 39:41

No, I think my favourite books are things like The Man Who Loved Only Numbers, and maybe I like, you know, books like the Google the Google guys or what was it called and Microserfs.

**Researcher 2** 39:59

Oh yes, Douglas Coupland

**P1** 40:01

Movies I do like sci fi stuff. I was just watching this one, it was only one season. What was it, they built this spaceship in 1963. And Ascension, I think it was called. So they built this spaceship in 1963 and put about 500 people on it. And and they and they sent it into space. But then from the beginning, there's something wrong about this whole project. And it turns out, it was never sent into space, it's still on Earth. They just made those people think they created created this. So they think they are to to actually studied how people would respond and live in these closed quarters you know. So the series happens 50 years later. So it was sent in 1963 so now it is what 2011 or something, whatever, whatever happening there and things started going wrong and so on. But I like like kind of sci fi stuff, lots of sci fi stuff. So internet. I got I, Robot is is a favourite of mine. I like Asimov books. I haven't read a lot for years and years. But I remember reading loads of Asimov stuff with my kids before, well, when I was pregnant with them, that's fine. Yeah, so

**Researcher 2** 41:48

But nothing really sort of springs to mind when you think about data or like also the keeping, keeping things accountable, keeping organisations accountable or

**P1** 42:06

No not something that springs to mind probably if I hear about something I'll jump on it I thinking digitalized kind of conferences, a few of them in the last year. And I've been buying some of the books from the people who've given talks there. Because some of them are along those lines, you know, some of those talks that you given us about. Oh what would it be? There's YouTubers, one on PayPal. Yeah, there's quite a few of different on and I haven't read them yet. They're all nice brand new books signed and everything. But they want me to read them. They're sitting there on my bookshelf, and I'm more and I want to but I keep forgetting and come and sit here in front of the computer. And then when I take a break, I pick up an ESP instead of a book.

**Researcher 2** 43:10

Thank you. Yeah, that was

**Researcher 1** 43:12

Is there anything you wanted to pick up on [Researcher 2]? Okay, I think that's about everything, then. Unless, unless there was anything in particular that you wanted to flag up to us that you thought might be interesting for us to know or, or any questions that you have just to finish things off?

**P1** 43:30

No, I don't think specifically I think if, yeah, what I wanted to ask was, where did you get your sensors from? Do you have a good place to buy them from?

**Researcher 2** 43:43

If you absolutely, I can send you a list of exactly where they come from, if you like,

**P1** 43:49

Yes please, I'd like to know what like, just like I said, because I want to I was thinking of making similar something similar to what you have. But I would add temperature and humidity

**Researcher 2** 44:03

I would add temperature now to be perfectly honest, as well. Especially given we had that those few days where it was pushing forty, I think they would have been a really interesting.

**Researcher 1** 44:15

Yeah, that would have been a no brainer, if we'd known wouldn't it?

**Researcher 2** 44:19

Yeah the only reason it's kind of not because there is a temperature sensor on the real time clock. But it's not I didn't want to show it on the board because it wasn't its own component. So that sort of make sense. But yeah, now I would totally be loading that.

**P1** 44:38

Yeah, so yeah, because like I said, I would like one of these in each room, which is the idea had the few years ago but never got to it. But because of the problem I was running into with the 826s Um, but these ESP32s seem to be much nicer. And I see they've got Bluetooth on too. I didn't realise that they've got Bluetooth

**Researcher 2** 45:01

Yeah, we could have surveyed by that but essentially, there was the library they use for Bluetooth. It's just takes up much too much memory and I couldn't make it make sense.

**Researcher 1** 45:12

We did some fun explorations at the start of the project, by going out and seeing what we could see as we walked around, and [Researcher 2] took his phone around and sort of detecting Bluetooth devices as you're walking around the city, and it was actually really interesting.

**P1** 45:29

Yeah. All right. Yeah. That would also be just like I wanted to do with the, with the Wi Fi, see what access point is? When I was in America while I did my PhD, I was for four weeks in with Illinois State University in Normal. Yeah, that's the name of the place, Normal. What a weird name. I remember there, if you go sort of up off the campus and into the main street, there were loads of access points, you just about always had Internet access, you know, Wi Fi access, because the shops had them. And, of course, some of them were better, but and the place is quite small. So but you literally could go from one access point to the next to the next and it would have been interesting in a place like that to see what you have on how many have and analyse where you could pick up the best signal and so on. But, yeah, okay, that's, that's Wi Fi, not Bluetooth, but the same thing with Bluetooth.

**Researcher 1** 46:36

Okay, fantastic well, thank you. Thank you very much. And thanks for giving us so much of your time over the last the last month or so. It's been fantastic we've like asked a lot of all of you. But you've all sort of humoured us and engaged fantastically. So we really, really do appreciate that.

**P1** 46:58

Would you like me, I don't know, if you would be interested in [my son's] Shiny app as far as it is now. I could send you a link to the GitHub repository. And if your repository is open for looking at...

**Researcher 2** 47:17

I can give you a if you've got you you've obviously got an account I can I don't want to make it totally public yet. But I'd be happy to share it with you by making you a contributor or team member or wherever you have to be in

**P1** 47:33

That would be nice if you don't mind its just

**Researcher 2** 47:36

You'll look at my code and go Oh, my goodness, what have you done there.

**Researcher 1** 47:42

We've been sort of all the other interviews, we're in person. So we've been kind of saying like, asking if they want to keep the probe for a bit longer or give it back to us. Obviously, you can't give it back right now. Anyway, so but if you wanted to keep it for a bit longer, that's that's perfectly fine we're we're not in a particular rush to get them back. So just hand back at your leisure.