EPISODE 1072

[INTRODUCTION]

[00:00:00] JM: Matterport is a company that builds 3D imaging for the inside of buildings, construction sites and other locations that require a digital twin. Generating digital images of the insides of buildings has a broad spectrum of applications and they are considerable engineering challenges in building such a system.

The hardware stack at Matterport involves a camera that is built in-house by the company and that camera can take a 360 degree scan of a room. It can stitch the imagery together and it can make the digital twin of that camera scan available on the cloud.

Japjit Tulsi works at Matterport as the CTO and he joins the show to talk about 3D imaging and his role as CTO. What he does.

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[00:01:21] JM: When I'm building a new product, G2i is the company that I call on to help me find a developer who can build the first version of my product. G2i is a hiring platform run by engineers that matches you with React, React Native, GraphQL and mobile engineers who you can trust. Whether you are a new company building your first product, like me, or an established company that wants additional engineering help, G2i has the talent that you need to accomplish your goals.

Go to softwareengineeringdaily.com/g2i to learn more about what G2i has to offer. We've also done several shows with the people who run G2i, Gabe Greenberg, and the rest of his team. These are engineers who know about the React ecosystem, about the mobile ecosystem, about GraphQL, React Native. They know their stuff and they run a great organization.

In my personal experience, G2i has linked me up with experienced engineers that can fit my budget, and the G2i staff are friendly and easy to work with. They know how product development works. They can help you find the perfect engineer for your stack, and you can go to softwareengineeringdaily.com/g2i to learn more about G2i.

Thank you to G2i for being a great supporter of Software Engineering Daily both as listeners and also as people who have contributed code that have helped me out in my projects. So if you want to get some additional help for your engineering projects, go to softwareengineeringdaily.com/g2i.

[INTERVIEW CONTINUED]

[00:03:10] JM: Japjit, welcome to the show.

[00:03:13] JT: Thank you.

[00:03:15] JM: You work at Matterport, which was started in 2011. What was the original goal of the company?

[00:03:23] JT: Obviously, the founder is the right person to ask this question. But the original goal of the company was to create a digital twin of the built world. An accurate 3D rendering of what the built environment looked like in a digital realm, but down to 1% accuracy, and not something that is like just a 360 panel of a particular room, but actually trying to preserve what a Parallax IC to what you can actually then see in the digital world as well in a very equivalent sense. That was really the intention behind it.

[00:04:02] JM: Why is it useful to have a 3D image of the world, or the physical world?

[00:04:10] JT: If you think about it from a perspective, and especially in today's day and age with COVID-19, it's become even more important to have that rendering available too. I'll just use an example of something just happened a week ago or so, a couple of weeks ago now. Everyone's been following the news, so you probably heard about GM having to build the ventilators on the request of President Trump. One of the things that happened as part of that task, GM requested Matterport to go out and – Matterport, the manufacturing plant that actually does make the ventilators, so they could replicate that exact same factory floor diagram on their side on their factory floor as a particular example.

When they could not go and visit and check out the setup, they were able to get a highly accurate, realistic model. It's not even a 3D scan or a 3D photo. It's an actual model we do all the way down to a point cloud with dimensional accuracy saying here is how much the height and width of a building is and then take that and ensure that we have a good model that represents what they want to build on the other side. That's just one example.

But in a real estate, there'll be another example of we can no longer visit a particular location or you're trying to buy a house from out of town. You're about to move to a new location and you want to buy a house in this town. How do you go and visit this particular house in this space? A third use case that we found a lot is in design building and operate, but let's take an example of construction. As folks are building a new building, what happens is there're overlays and there are inspections that need to happen. We can start to do virtual inspections just by Matterporting the place [inaudible 00:06:17] and allow the inspector to be able to do that from far away. We're seeing that actually happening in insurance as well.

[00:06:26] JM: The example of the ventilator factory. So if I heard you correctly, GM needs to make ventilators with their existing car manufacturing plants and they want to replicate ventilator factors. So they take a look at a 3D mapping of a ventilator factory and then they want to replicate that inside their car factories?

[00:06:51] JT: Correct. The way most factors work is a lot of the equipment that they have in place is actually relatively generic equipment. When you have a stamping equipment, for example, that stamps metal into certain shapes and sizes, it can stamp metal into whatever

shape and size that you want. You just have to kind of give it a blueprint of what to stamp and how to stamp and what to cut and so on. CNC machines as an example.

The point is what you're replicating is the line structures, which is like what the line – What do you start here? What is the next thing? Where do you go to the next thing? So on. If you've ever taken a tour of like the Tesla factory or any factory for that matter, especially car manufacturing, it's purely the line that they are building, because the machinery actually is very common place machinery, which is a generic piece of machinery that they do and its job in that line is to do one specific thing even though the machine can do 12 very different things.

[00:07:54] JM: Very cool. The process of getting a 3D image of the inside of a building, can you walk me through that?

[00:08:06] JT: Sure. The one thing I will tell you is like it's a 3D model. It's not really just a 3D image. One of the differences between what you might see out in market when people are talking about a 360 degree view or a 3D image for that matter. What Matterport does, which is unique, is this idea that we have a full 3D model. Think of it as an architect putting together a structural diagram of what your house might look like. Once we are done Matterporting a space, we actually have a very highly accurate essentially CAD exportable model that an architect can actually take and then go in and do something with that model. Because a part of Matterport's value proposition is we do have a camera that we produce, our own hardware that we product that has a sensor that does depth prediction, as well as depth sensing to allow it to build out that particular model to that dimensional accuracy. It's not only beyond just a pure image. We not only have the image, but we have the depth, and so we can project the image at the right depth to make it look dimensionally and what would look like visually accurate as well.

In terms of your question of how do we produce this model. The way we do this is we have a concept of a sweep, which is essentially the Matterport camera along with the assistant application, the Matterport capture application. You just place the camera. You hit the button. It does a sweep. Then you move the camera to another location and you kind of keep doing this all the way around a space that you want to Matterport.

The idea is the application itself and our underlying artificial intelligence actually keeps track of where all you have placed the camera just purely by the fact that we have the dimensional data and the image data. We can connect all of these different images and depth data as you're walking around with the camera, and then we produce a highly accurate model at the end of it.

We auto-detect when you go up and down stairs. We auto-detect windows and walls. We are very accurate in terms of how a particular mirror might reflect an image. We do a fair bit of work in terms of knowing and understanding what's happening. That's part of the core engine that we have built over the years.

[00:10:45] JM: There is a piece of hardware required here. You have a camera that does the imaging process. What's the role of the camera?

[00:10:59] JT: The way that we look at this is we have one of our own cameras. We can use a 360 camera. We can use some high-end. There's something called a Leica BLK, which is a very high-end LiDAR-based camera. The idea behind the camera is the capture of both the depth as well as the high quality image. The way we do that is through the camera.

The second part of that is taking all of that set of sweep, the image sweep that we have of all of the location and then kind of coalescing that down into a single model, and that's where our secret sauce really lives. If you've seen kind of a 360 panel or a 360 camera, they just take a 360 as singular shot or a singular video at that point. Beyond that, what we do is we kind of have the ability to be able to collapse all of that into building an actual dimensionally-accurate model. That is what you get after taking those individual sweeps.

I don’t know if you’ve actually looked at a Matterport model, but that's usually the easiest way to show folks, is once you first time you walk-in, you were like, “Wow! Who would you do that? How was it so accurate?” I feel like I was immersed in there, and really that is the intention behind it, is we have the ability to kind of immerse you into that model in a way that nobody else does.

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[00:12:38] JM: The Intrazone is a biweekly conversation and interview podcast about SharePoint OneDrive and related technology within Microsoft 365. Get highlights on usage, adaption and how SharePoint works for you. Subscribe to The Intrazone today. That's The Intrazone, I-N-T-R-A-Z-O-N-E. It's all about show SharePoint fits into your everyday work life. The goal being to more easily share and manage content, knowledge and applications and to empower teamwork throughout your organization with the technology that you already have.

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[INTERVIEW CONTINUED]

[00:13:54] JM: As far as making the cameras, is that process where you have entirely vertically integrated manufacturing to make these cameras or can you take some of the camera hardware off-the-shelf? What's the hardware engineering process that goes into making the cameras?

[00:14:14] JT: When we started out in the first [inaudible 00:14:16] phase a long time ago, and this predates me, but the cofounders and a set of folks, actually, we did do our own vertically integrated hardware manufacturing design and build within the US. Most of the actual manufacturing happens within the US. Part of it was sourcing parts that made sense, the depth sensing, equipment, as an example, on the camera, the image sensing equipment. We built what we call the Matterport Pro 1, and then since then, then since a Matterport Pro 2 camera. We've actually built an integrated and manufactured that actually wholly within the US out of our Sunnyvale offices.

We have a hardware team that is nothing but think about not only kind of the hardware R&D and research, but also the sourcing of parts and manufacturing of parts. **[00:15:12] JM:** What about the software that runs on the camera? Is that stuff that's entirely written in-house?

[00:15:17] JT: That is all stuff that is entirely written in-house. We write own firmware. We write all our own software, and then a lot of the back-and-forth, including the intelligence that is part of the computer vision technology that we use is a combination between the hardware, the camera, on-device software, the software that's on the handle device that is used to capture those images, and depth data, and then our pipeline that lives in the cloud. We do all that all internally.

[00:15:50] JM: There is so much surface area to the entirety of the company. You're the CTO. You joined four months ago. What has been the process of understanding the company and getting to know the different areas of the company?

[00:16:12] JT: Right. I'll talk right about that, but to your point, it is a very large surface area. One of the cool things that really interests me in the job in the first place and got me excited about is the technology footprint is very, very large.

We have, as you just noted, there's the hardware side, there's het hardware and software components. There're the capture components within the mobile device, and there's our pipeline. I didn't talk about this, but there's also the web showcase and GL. How do you actually see a lot of the information within the web portal or on our mobile devices?

There is a good lot of amazing underlying great technology that has gone into it. One of my favorite parts is like when you think about when people talk about AI in today's world, everyone's an AI company. The cool thing is like we're truly an AI company. We've spent so much interesting time and energy into building out these models and building out the computer vision technology that actually powers this all the way from our hardware to our software and then our showcase. That's what got me really, really excited.

As I was coming in, my first probably month was nothing but a lot of deep dives into individual product areas. Sometimes three or four different deep dives to actually know and understand a lot about what's going on. I can't tell – I am still ongoing just for the record. I still find out new and interesting things that are important that facilitates this whole transfer from a built world to the digital twin that we have in place. Still learning a lot, but yeah, it's been a lot of deep dives across the various project teams.

[00:18:01] JM: All right. Well, one specific question I'd like to ask you to get us just a small view into the engineering. If I have a camera inside of a house, let's have got a big house. I put the camera inside the house and I take a model of the house, and then that model eventually makes it to the cloud and is indexed in a way that I can look through it. Can you take me through that process of capturing the inside of a house and then indexing it and putting it to the cloud, how it gets the cloud.

[00:18:42] JT: Sure. As I mentioned, what you do is you essentially start in a room. You put the camera in there and take a sweep, which basically takes multitude of different images at different depth across the room. Then typically you actually place it three or four times within the same room as well. You try and get a different level image information and depth information from three or four different spots within the room and then you kind of just keep moving.

Our general recommendation is you start at a place, you kind of rotate around. Make sure you get a center image shot as well with the depth and then you kind of move to the hallway, the entrance doorway, and then you kind of keep going up and down the various parts of the house. Depending on the size of the house or how detailed you want to get, you can take more sweeps or less sweeps. Essentially, a sweep being placing the camera and hitting capture within the device. That's pretty much it. It's actually pretty dead simple in terms of from a user perspective what you need to do. But at the same time, there is – It's just is a matter of taking a sweep and then ensuring that it aligns on the device automatically and it kind of providing you guidance as you walk around the house.

Once you've finished kind of taking all these sweeps, and so let's say within 1,500 square-foot house, you might take 20 sweeps across multiple rooms, and in hallways and closets and whatever else you want to do. You take in the 20 sweeps, then you upload that as a whole package into our cloud, and then the cloud goes to work and essentially sequences everything. Does a high-resolution point cloud of everything that you've taken, aligns all the flaws, does some cleanup, and a part of our core secret sauce, to make it look photorealistic with the full death capabilities. Then you get that available to be able to walk through in the web GL showcase which allows you to kind of walk, get a dollhouse view. You can get some videos, fly through and so on. You can actually even go in and do some level of editing cleanup and such

that you want [inaudible 00:21:02] For example, we have the ability to do blowout faces if they are within a particular environment for privacy reasons. You can blow those out, and so on. The whole start to finish, you can pretty much do within a few hours depending on the size of the job and then go from there. Relatively easy, pretty simple in a lot of ways.

[00:21:29] JM: Is the camera taking one big continuous picture or is lots of small pictures that you then have to stitch together?

[00:21:36] JT: It depends on the camera. Depending on the camera, for example, we also allow multiple 360 cameras to be a part of our ecosystem, and we'll partner with a set of different 360 camera providers. So in that case, it's just one image that you get, and then it's one image per sweep. In our particular case, we do a little bit higher quality and higher dimensional accuracy. So we do take six sweeps per location. But we do the camera stitching on the camera itself.

[00:22:13] JM: Okay. You do it on the camera itself, and is that compute-intensive? Do you need special chips for that or is that – Can you just use commodity chips for it?

[00:22:24] JT: We built, like I said, our own cameras. We do have some specialized primarily off-the-shelf, but we've sourced and planned that out ourselves.

[00:22:34] JM: Okay. Does the image need to be at all compressed or down sampled in order to make it small enough to work with, or like what's the right fidelity? Is there some ideal bit rate that gets the image small enough, but also still maintains the fidelity?

[00:22:56] JT: No. We don't downsize. We take the highest resolution possible imagery and we do have within our models the ability to – As were doing some of the stitching, the aligning off the various other sweeps. So from sweep to sweep, aligning everything to go through that. We actually do it at the highest resolution possible just to ensure that we get the – Again, the dimensioning accurate and visible, best visible quality as well. We do do that at a high-resolution.

[00:23:32] JM: Is there much a component of machine learning to the image collection and image stitching?

[00:23:42] JT: 100%. To my earlier point, like it's true computer vision and deep learning at its core in terms of being able to utilize a lot of the capabilities. We've also – As you probably know, machine learning, deep learning is a lot about quality weights. The training data sets that you have and how we can actually improve. That's one of the key criteria. We have over 2 million models within the database, and so we can learn and train across a lot of those.

[00:24:19] JM: What are the aspects of creating a 3D-rendered model of a room that machine learning can play a role in? Is it specifically teaching a model to be able to identify like matching edges into two images or is it kind of making the – Inferring from a 2D image what the depth is in different components of the image? What are some areas of the post-processing? The camera post-processing that can be assisted by machine learning?

[00:24:58] JT: The way that works is there's aspects all the way alongside. Starting from on-device camera stitching. Second, on the capture devise, the phone assistance application. We do alignment so that we make sure that we have enough alignment data. That's essentially finding the right grain of objects in aligning the prior sweep to the next sweep and ensuring that you have some continuity so you can actually get an aligned view of that room at the end of it.

There's some work that has to happen as part of that. So we kind of do what will be called the preliminary stitching across the various sweeps that exist. Once it goes into the cloud an the pipeline, we do some fairly heavy duty work in terms of now getting that alignment map to be precise. Every camera, when you place it on a particular space, the angle could be off by just a little bit.

As you can imagine, as the distances grow, that angle alignment can go higher or lower. Getting that correct over the space is important and you have to obviously do this all automatically, so part of the learning process goes into that.

From there, from every different angle, how do shadows look? How does a furniture look? How do different angles looking out into the yard or even in external outside photographs looking back in? There is interesting problem sets with mirrors and interesting problem sets with windows, because they reflect differently. There's a whole multitude of things that have kind of

gone in over the years that actually solve a lot of these problems and they're all done through the learning engine to begin with.

[00:26:52] JM: You've had a number of previous roles in engineering leadership, and now that we've talked about the contours of Matterport in some detail, I'd like to get the management perspective. Your previous roles have been at eBay, Google, Carta, Microsoft, YouTube, some different places. What is new and distinct about this job?

[00:27:19] JT: The interesting part – I would say the combination of hardware-software and the full gamut is different. Most of my roles every single time I've taken them has been for some level of learning, something new. I've been lucky enough to have worked at some great companies over the years, and part of that has been – Even within the companies, I've worked at multiple roles sometimes. It's always been the intention of learning something new. I would say specifically with Carta, it's very specific. Matterport, it is learning something new with the intention of that hardware, to software, to showcase gamut. With Carta, it was financial technology. I didn't really know a lot about it. It was really interesting to kind of earn something from that space.

Before that, for the last decade or so, I've been in some version of machine learning and deep learning across the different systems at Microsoft. It was building product ads, which is a large-scale pipeline with a search engine for the frontend and then advertising from a user perspective. At Google, I did
Google analytics and I did YouTube long form media. Not very different roles with the intention of learning something new.

[00:28:34] JM: Tell me about the management structure at Matterport. You have these different components of the company, like hardware and the software that runs on the hardware. I imagine the microservices or cloud services. Just tell me about the different areas of the company.

[00:28:55] JT: All right. The product side, the engineering side and then the hardware side, which I actually share with a colleague of mine who does a lot of the manufacturing components of things. Then in this particular case, and I think now from a few years perspective, I kind of

own both the product side and the engineering side of the equation. Usually it's teams within that.

My management structure or philosophy has always been that try and find folks to do whatever they are most excited about or most passionate about. As a result, I have kind of a strategy that says your HR manager and your tech lead can be two different people for sure. Your HR management is really meant for your care and feeding as a human being, and your tech lead is really meant for the care and feeding of the project that you are working on. Sometimes they align. So your HR manager and your tech lead might be the same person and sometimes they are two very different people.

What that allows us to also do or allows me to do anyways, make sure that you have an IC ladder that is as deep and broad as a management ladder. Not every person needs to become a manager and not every – As such, it allows folks to have multiple different paths of quote "growth" within their career.

Something I think I probably learned from my Google days, because one of things I think Google did really well was this idea that you would basically be an individual contributor and be a fellow, all the way up to a fellow versus having to become a manager to grow in scope or impact and such. What that led to was is most people wanted to be some of the key critical distinguished engineers that Google had. Very few people actually want to be managers, which is in my opinion the right thing to do long-term.

Most people don't want to be managers. The minute you try and start building a management organization structure with managers reporting to managers and so on, I feel it relates to politics. I've tried to Keep the management side independent of the tech lead side and allowing for growth on both sides. The organization is structured that way here as well. Then you try and provide career growth and career ladder kind of across both of those folks who are interested in either.

[00:31:28] JM: Is there a path for people who are not planning to stay at the company. If there are people who their idea of or their vision for what they're going to do with the company is, they're going to stay there for 18, 24 months and then they're going to leave and go somewhere

else. Is it important to provide a distinct track for that kind of person or do you just slot them into the management or the IC track that they're currently on with the wider scope of their career?

[00:32:05] JT: I'll answer that side differently. To me, that's orthogonal of whether or not they get started into an IC or a management track. I think what you're talking about is longevity within the organization.

We live in Silicon Valley. The average tenure is anywhere from 18 to 3 years, depending on the size, scope and scale of the company. What I've always found as a tenant is the way that you keep people is not by anything else, but are they having fun in their job? When they come to work, are they learning something new? Are they working with people that they can trust and learn from as well? Then are they kind of shipping early and often?

From a pure – What I find keeps most people happy in their jobs is if they're hitting on all those four things. To me, it's less about like, "Hey, we're going to tailor something for you, but as an organization or a company, can we make sure that the right set up or the right culture is set up from get go? That your friends are here, you're actually having fun. You're learning something new. If we can get you all those things, you can still decide to go. That's totally fine. Look, no harm, no foul. We'll happily encourage you and help you get to the place that you want to go work in or you're really passionate about. But it could be here, and we want make sure that the right style and culture is set up."

I've, again, like I said, lucky enough to have teams where that once you setup that culture and you set up that environment, most people are more than happy to stay. They might move and they're a great place to even come back down the road if they find the right thing was at Matterport.

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[00:34:09] JM: Over the last few months, I've started hearing about Retool. Every business needs internal tools, but if we're being honest, I don't know of many engineers who really enjoy building internal tools. It can be hard to get engineering resources to build back-office applications and it's definitely hard to get engineers excited about maintaining those back-office

applications. Companies like a Doordash, and Brex, and Amazon use Retool to build custom internal tools faster.

The idea is that internal tools mostly look the same. They're made out of tables, and dropdowns, and buttons, and text inputs. Retool gives you a drag-and-drop interface so engineers can build these internal UIs in hours, not days, and they can spend more time building features that customers will see. Retool connects to any database and API. For example, if you are pulling data from Postgres, you just write a SQL query. You drag a table on to the canvas.

If you want to try out Retool, you can go to retool.com/sedaily. That's R-E-T-O-O-L.com/sedaily, and you can even host Retool on-premise if you want to keep it ultra-secure. I've heard a lot of good things about Retool from engineers who I respect. So check it out at retool.com/sedaily.

[INTERVIEW CONTINUED]

[00:35:45] JM: More than a decade of your career has been spent at Microsoft and Google, and these are really big companies. I'd love to get your perspective for how these – The management structures of these companies compares to the startups. You've work at Matterport and Carta now as startups. How does the org structure differ between these two classes of company, the smaller company that's in a rapid growth mode versus a gigantic company with really, really proven financial dynamics?

[00:36:22] JT: Is interesting you ask that. Microsoft and Google, in my opinion, very similar companies. Just about 10 to 12 years apart in age. This is always a funny notion that I had when they moved from Microsoft to Google [inaudible 00:36:36] popular one because Google prided itself on being different. My point always back to the team was, "Look, it's not that it's different. Microsoft in its heyday was known for hiring some of the best people and then letting them go and letting them build letting them build whatever they could possibly build." I think Google as well has showcased over the years.

To me, the mark of a great company, not a good one, but a great company is how well do you pivot with the changes. Can you actually pivot and modify your behavior as things change, as the environment changes, as the economic environment, or things that you need to do change?

Then beyond that, going back to that idea, like are you having fun? Are you working with great people? Are you learning something new? I think both Microsoft and Google embody that in space. They've really managed to keep an excellent level of talent and build that out.

Within the companies, large companies, most of the time you primarily work with your product team, and this is true for almost all. As size grows, you tend to build divisions and then product areas, or focus areas, and then kind of like you have groups that are company size groups of work. A smaller startup, to me, the only difference is in a larger company there is still some oversight or maybe an umbrella that you have available to you. In a startup, you don't have that. It's you. You are actually providing that umbrella and that oversight to pretty much everybody else.

There is nobody to fall back on and say, "Hey, how come you didn't help me with this?" It's you in a smaller company, whereas in a larger company, there might be some level of oversight and an umbrella, a shelter provided by the larger group. Larger companies have a little bit more politics. Most places have politics. They just have a little bit more cross-functional politics. It actually matters how you can or not play some amount of those. In a smaller company, if there's politics, then it's probably generated by you. You have nobody to blame but yourself.

I think at the day-to-day working environment, prioritizing, scheduling, building teams, I wouldn't say there's much difference between the two. It's just you got to go get the stuff done. At a smaller company, there's nobody else. It's just you.

[00:39:09] JM: I know you've only been with the company for four months, and within that time, there's been this rapid shift due to the coronavirus outbreak. How has the business and the engineering team shifted since the outbreak?

[00:39:23] JT: Yeah. Look, it's an unprecedented time. I was meeting with some of my colleagues from –Or various CTOs or CPOs within the valley of most of the team, companies that you've heard of. I think one of them called it a black swan event. It is an unprecedented time. It's also something that force people to work remotely, which is different and not something that most people are used to.

From a business perspective, Matterport actually is poised quite well because we help build a digital twin of that built world. In some ways, it's been very valuable. The example I use with GM a few minutes ago, it's been actually quite valuable for a lot of our partners, on our customers, to be able to rely now on Matterport.

We've actually seen some unprecedented growth over the course of the last six weeks, because almost anybody who would have in the past actually traveled to a destination or a location or a construction site or some other insurance as an example, and factory, and real estate, they all need that digital twin to be able to travel to it. Because there the need hasn't gone away, but the ability has gone away.

What we offer is that ability today saving. Even in the past, we had this concept of we have a team that does capture services that it's kind of a soup to nuts operation that if you want to Matterport a space, we will actually send a technician, a capture technician out and they will do that work for you and you will have a built model at the end of it a day later. That's how we did the GM model, for example. Our capture technicians actually went out and got that model.

The reason we have that is they also HAZMAT certified because we've had to do that for insurance purposes, or I should I say for insurance customers where you've had a kitchen got burned down and insurance needs a full digital appraisal of what happened and they want imagery for purposes of their records as well as for appraisal purposes. We have HAZMAT certified capture technicians. So we've been able to actually also really accelerate that business in a massive way.

The overall numbers as a result of COVID-19 are positive, and I hesitate saying that because it is a massive economic drain and it's going to impact us over the course of 18 months. At least for the moments, for Matterport, it's been positive.

[00:42:16] JM: You've seen workflows in construction, for example. They've been forcefully digitized due to the outbreak.

[00:42:27] JT: They have to, because an inspector can't go there. An insurance – Because life is still going on, like people are still – Things that were happening six weeks ago are still

happening today, but know the insurance company can't send out a inspector to a location. So what we do is we can take, like I said, full-on realistic three-dimensional scan and a model and recreate that for the inspector, where the inspector can actually walk around and see what happened. It also saves them time and money because, a scan technician versus an appraiser, the cost value of that is the appraiser can actually do more appraisals now and send in a lower cost technician to go scan the space. It is actually changing the business model for a lot of these, a lot of customers in a lot of ways.

[00:43:23] JM: What new processes have you put in place in the engineering teams at Matterport?

[00:43:30] JT: One of the things about R&D or software and product, a lot of us are more used to working remotely. We also have multiple remote teams already. We're not all based in Sunnvale. So we were quite used to working across Zoom. What's happening now is everyone's remote. So we've just kind of expanded that out. A few things that have changed probably is water cooler talk, is missing the hallway conversations, are missing the ability to go get lunch together and such are missing. We are doing fair bit of work to just check-in with the teams a lot more. Actually have water cooler stock rooms, have water cooler Zoom meetings that people can show up as they can kind of come in, drop-off, and so on, just to make sure that the camaraderie that is very important in a company kind of continues on as we are in the shelter-in-place. But beyond that, I would say the work kind of continues on. We're still launching on schedule and there are obviously some changes to how it's working. But for the most between the collaborative tools, Slack, Zoom, some of the water cooler work that I mentioned, it's business as usual.

[00:44:46] JM: All right. Well, maybe we could just close off by do you have any predictions for the element of construction work being digitized from the forceful shift to the coronavirus? I mean, I'm sure that was something that was happening. There was a trend that was already occurring where you had construction sites and architectural reviews being improved or enabled by the technology like Matterport. Do you have any other predictions for fields that are going to be changing because of 3D modeling technology?

[00:45:23] JT: Yeah, besides construction, factory, factory visits, safety and security. There are – I didn't talk about this, but one of the other areas that we're really investing in is Matterpoart as a platform. We look at that 3D model with high-dimensional accuracy as well as photorealistic as a platform that can then be built on by other developers in the marketplace who can take that and build further things on top of it.

As a simple example, I have an unfurnished model. I want to furnish it many different ways. I want to color the walls. I want to put different furniture in. We have the ability to be able to do that today. In fact, one of my favorite examples is we have an unfurnished model of this place in Manhattan just as an example. The ability to be able to place mirrors and get, again, very accurate information of what the skyline would look like if you were looking at this mirror is something that we can do today. As our partners are already starting to build on some of these capabilities, we also have a global footprint as a result. We have partners across the world who are also realizing some of the value of this. There's definitely aspects of not only the hardware component, the software components, but now our develop platform components, where our developer platform partners are starting to build out really new and interesting ideas on how they actually can take what is the core of Matterport offering and then build on top of that something new and interesting for either their customers or for customers as a whole of Matterport.

[00:47:10] JM: Okay. Japjit, thanks for coming on the show. It's been a real pleasure talking to you.

[00:47:15] JT: Same here. Thank you for having me.

[END OF INTERVIEW]

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