

Autodesk University | Using IoT for Predictive Maintenance

DENNIS PLATT: I appreciate everybody coming up and taking the time. You guys just came by-- earlier we talked. Glad you're so interested. Anyway, my name's Dennis Platt with a company called Panoramic Power. We are an energy management software solution technology company-- been working with Autodesk for a few years. They were actually an early investor in our company at one time. Recently, we've been acquired by a different company, but we're still friends. So we're still here, but we're going to talk today about IoT and predictive maintenance.

So if anybody thought it was something different, now's your time-- jailbreak and run for it. But for the next little while, we'll talk about IoT and predictive maintenance. I got a bunch of slides to go through. I'll give some information. But by all means, if anybody has a question, comment, suggestion, better idea, feel free to share with the group. And I don't need to just stand here and lecture you guys. So you know we can have a discussion at any time. Any questions as well. So try and keep it a little bit interactive and a little more fun, as we're at the end of the day.

So having said that, so a few statistics. Probably nothing shocking-- stuff that you may already be well aware of. But when we talk about maintenance and operations, a lot of costs involved in that and a lot of people looking to save money at the end of the day. And I apparently have to stand here and do the slides, so I apologize if I'm not moving around or being more interactive here.

But 80% of the lifecycle cost is in operations. And as of today, I think this number is actually even higher now. But a lot of that cost remains reactive, right? So just something breaks, and we react to it. And we go and fix it or try to, and if it's not too late, we still have a chance to fix it rather than replace it. And that's what we talk about here is that with IoT and the big talk around IoT, and connected devices, and connecting buildings, and so forth is moving to that next step of being proactive rather than being reactive.

And hopefully that's why a lot of you are here today is to kind of learn more about that and what are the opportunities available in order to do that. And you know is there technology or other ways that we can look at that. So again, that's what our company focuses on a lot-- is the ability to predict and prevent rather than react and replace, and obviously a huge cost savings in the ability to do that. And we'll talk more about that as well.

So kind of a strange guy, but how do we do that? So we kind of look at the problem a little bit and realize that probably half the buildings out there-- and it may be even higher than that-- don't even have a real good way to measure or manage what's going on within a facility, a building, whatever it might be. And that old-- come on in, sorry. We got started a little early. I

apologize. You didn't miss a lot.

But we can't manage what we can't measure. We hear that a lot in kind of an old saying, but it's still true. And if we can't see it and we don't know about it, how we're going to do anything about it? And that's what IoT is sort of bringing to the forefront today-- is having the ability to do that. The challenge is with a lot of solutions that are out there, it can be complex. I mean as we know, in any of our buildings and facilities, there's a lot going on. And so to deploy a solution to be able to do that can be time consuming. It can be costly, and it can be time consuming. And by the time we do it, what have we missed?

Or in the same effect, now that I've taken two years to do this, probably something better has even come along that, man, I wish I would have waited longer. And that's a lot of what we see out there is people kind of waiting-- well, I know I need to do it, but not ready yet. I want to give us some time, see what else is out there. And technology is changing constantly, right? We all know that. So finding solutions and ways to manage and measure, but being able to do it quickly and cost effectively, is kind of the goal.

The other piece of it is how do we get information today, right? And so everybody sitting here-- phone on the chair, phone on the chair, phone on the chair, right? We're all holding it constantly, looking at it. And so we want to have solutions that work for us. So we don't want to have to go to somewhere else to get the information and collect it and all that. We want it to be at our fingertips. And so all our workers are mobile, why aren't our solutions mobile? And again, that's what IoT is bringing to the forefront. A pause for pictures? We're good? OK.

So making it a reality. And just populate all this here. So kind of a simple formula that we play around with in order to get to that end result and that end game. So actually having devices within the facility that we're looking at, how do we actually monitor or measure that, right? And we talk about sensor technology, and we'll get more into that. But using sensors and sort of moving through the formula to get the information that we need, and that's kind of what IoT is now. How do we connect all those things together as the Internet of Things, and get the information sort of in that mobile application that we're talking about.

Again, I'd just rather see it all at one time. But what we like to say is, think big but start small, right? How to eat an elephant, and all those things. But sort of laying out a process or a program to do it. And a lot of these you can do real quick. Some of them take a little bit time to think about. But having the plan in place to do it is going to make a lot more sense at the end

when you get there. So what are the business goals? What are the use cases? How do we get that?

And eventually, we get into the technology, and the solution, and being able to take action on that. And that's really the key. And we run into that a lot with customers is that everybody-- I want the data. I want the data. I want to measure that. I want to monitor that. I want the data. And then all of a sudden, they get all this data. And it's overwhelming. It's too much. And it's like, well now who understands the data? Now I got to hire somebody else to look at the data. So we have to be careful.

We have to ask ourselves, clearly within this, what are the goals? What am I trying to accomplish? If I did know that, what would I do with it? And at the end of the day, would I take action for it? So I know that my air conditioning system is not working properly, or something's going on here. But do I actually have the resources to do something about it? Not just go buy new equipment, but do I have people? If I know this doesn't work, is there somebody who can actually go and look at it and fix it and take action on it?

So it's an important step. It kind of gets lost because we just think data, data, data. We want to know, we want to know. But you can know everything you want, but if you're not going to do anything about it, then what's the point, right? So you just want to make sure that at the end of the day, if you're going to invest and take the time to do this, that you're actually going to get results from it, right? And at the end of the day, that comes from you.

Again, scare tactic, but a lot of truth in it. There are companies that are moving forward and taking advantage of technology, and solutions, and bringing information to them, and then taking action on it. And for those who choose not to do that, there's the potential of getting left behind. And we see that in a lot of industry as well. But it's just one of those stats.

So what does it really look like? And from connected devices and connected buildings, we kind of get down to the basic layer of what is it we're looking for-- what are we trying to monitor? How are we doing predictive maintenance is what we're talking about. And so we look at different components, or different assets, within a facility or a building, it can be anything-- a motor, a pump, a compressor, a fan, a chiller, whatever it might be. But they all have their own profile, right? They all operate in their own way.

A little dramatic, but like a cardiologist evaluating a person, and your heart beat, and taking those readings, an asset can do the same thing. And you could have five of the exact same

motors, but they all run a little bit different, right? They're not always going to be exactly the same. And so understanding that profile of how that machinery operates is going to be important. So when it's not operating the way it should, just like you feel something doesn't feel right or irregular heartbeat or something like that, you want to have it looked at. It doesn't mean you're going to keel over here, or the piece of equipment is going to blow up.

But if I have the chance for that motor to raise its hand and say, hey, I don't feel good. Can somebody come look at me? Now we're doing some predictive maintenance, or we're having the opportunity to prevent rather than replace. And that's kind of the key. So how do we do it when we're talking about IoT? We kind of get into the sensor technology. Happens to be our company makes these neat little sensors, and as you can see in the person's hand, they're very small. They're tiny, wireless, self-powered, so you don't need much.

And I'm talking about energy monitoring at this point. But you can take this, and kind of the way we implement it is using sensors, communicating through a gateway or a bridge, and then sending that information to the cloud, and maybe it's going to be interpreted with other data as well, and sending it to an analytics platform. And whether that's just downloading an app from the app store and having it on your mobile phone, or getting into some more critical data analysis and analytics through a web based app, you know you can do it from that way as well.

And if you want to export that data into a building management system, or an energy management system, things like that, or bring data into the other system, that's when we started talking about connecting and getting sort of more bang for our buck. But solutions like these that are available are extremely inexpensive in the big scheme of things and super easy to deploy and install. There's a whole different way to do that. But when we look at an installation like this, when you talk about your wireless and self-powered, these little sensors just clip into an electrical panel. So they clip right on the wire. You don't even have to turn off the power to install them, versus kind of the old technology.

Still a good technology. Still mostly around because this other stuff's so new. But when you talk about wiring something the old way-- shutting off all the power, taking a whole day to do this-- versus something you could just do in a matter of minutes now. And actually get the data in your fingertips versus having to go back and look at a power meter or other things in accumulating that data. I'll pause for a second. Any questions? Comments? Making sense? Not making sense? OK. We'll go on.

So again, talking about ways to get the data. I kind of mentioned already being able to get detailed information in a multiple ways. So you know whether it's sending data in real time to a facility manager, or a maintenance manager who's in the field actively working on-- most likely being reactive to problems, but now given the information to be proactive. So a guy in the field gets it on his phone, gets an alert, a notification, and he can say, huh, this thing doesn't look like it's running right, something's not cycling, whatever it might be. Let me go take a look at it while it's happening, right? Because that's the biggest thing.

We go to the doctor, and it was like, well it used to do this. It used to hurt when I do this, and now it's not, right? So they always want to replicate the problem. So if you could get somebody out there while the problems happening, it's going to be a lot easier to fix it than to try and figure out what it was beforehand. But then you're maybe sending reports or other information to different levels of the organization that are tracking, and maybe they're tracking for energy efficiency reasons. Maybe they're checking for billing purposes. It could be a lot of different reasons where that information's going, but it's making sure throughout the organization, the right people have the right information to make decisions and react to it.

So if it's a matter of fixing something, or it gets to the point of replacing it, well what's the ROI look like to do that? And do I have enough information to know hey, what would the savings have been one way or the other, and can I justify a use case for maybe something extra in the budget? So a capital expense that might come up. That's really uncomfortable.

Anyway, so again, all the kind of different people I was talking about that are looking for the information. This one does the same thing. So the different types of stuff that we look at in terms of sensor technology-- we kind of cover three areas, and so there's kind of energy efficiency, there's operational efficiency, and then there's the predictive maintenance that we're talking about here. But all three go hand-in-hand. So if I can identify using sensor technology-- as long as stuff's on when it should be on, and off when it should be off, or is it cycling, or operating, properly at the right times, right? That's kind of easy, low-hanging fruit what we call energy efficiency stuff. And you can find a tremendous amount of savings in that.

We take that a step further, and we can look at operational efficiency. So a good example operational efficiency-- a customer, cement company, huge conveyor system. And they're taking huge boulders, moving them on a conveyor belt to a machine that makes them into smaller boulders, to another machine that makes them smaller, and eventually you know into little pebbles. So the sensors are able to detect that the conveyors are running, but there's

actually no rock on the conveyors. They can tell the intensity of the energy that's being used. And they can see when it's running empty.

So we get very excited and say, hey, you're running these conveyors, and they're wasting all this energy. There's no product there. You should turn them off when you're not producing. And the customer's saying, no that's not right. It is. The sensor doesn't lie. It's telling us it's empty. Turn it off. And you could save \$15,000, \$20,000 in wasted energy, and back and forth with this discussion.

And what the customer was saying was that the conveyor should never be empty. We run 24/7, and there should always be product moving on the conveyors. And it turned out it was an operational thing, that somebody was taking breaks, and then somebody else was supposed to fill in to make sure, and they weren't following the right process. So it was just a training issue. And what the company figured out is they were actually losing \$270,000 in production loss.

And we were excited because we thought we saved them 15 grand in energy efficiency, but it turned out an operational issue, and they were losing \$270,000 of production just because there was just a mishap in training, or a new manager came in, or something had happened. And they didn't realize what the process was. But without the sensors being installed, they never would have caught that. They had no idea that that was happening, strangely enough, to lose \$270,000 and not know why, but that's what it came out to be.

And so the energy efficiency, the operational efficiency, and then the predictive maintenance, which is a huge part now. And when the company started with the sensor technology, that actually wasn't one of the things on the plan that they were looking to focus on, but kind of stumbled into it in a weird way. And it's now become an instrumental pillar in what the sensors are used for. So being able to actually identify how, like we talked about, the profile of an asset-- how that asset operates and understanding its parameters and knowing when it's outside of those parameters.

So even if it's something as easy as I have a compressor, and it draws 10 to 12 amps. And so if all of a sudden it's drawing 14 or 15, the system will send an alert or a notification saying, hey this compressor, maybe it's overcycling or something's going on, right? So go and fix it. That's an easy one. But now, with a lot of machine learning that's added in these algorithms into a lot of different software platforms, that you really start to get a history-- like I mentioned

earlier, five motors all exactly the same from the same manufacturer-- but each one has a little bit of different profile.

So if the system can actually machine learn what that motor is doing, even though its pulse is 120 versus another one's is 110, they're a little off. So when you know what each one is doing, and you can manage to that, then you know how it's going to operate. And that's when you start to get into some real predictive stuff, which is really cool. Yes.

AUDIENCE: Do you take in other data? I mean, I'm imagining, like your rock example, [INAUDIBLE] trust this much power when there's rocks on it, as much as when it's off, [INAUDIBLE] what other type of data to understand what's going on? Or could also maybe use data from other sensors, too, like temperature or vibration.

DENNIS PLATT: Yeah, so we can-- currently we're doing temperature sensors, as well. Also, within a software, you can do-- we have just outside temperature as part of it. So if you're looking specifically at HVAC systems and things like that, and maybe you have multiple sites and you want to compare these three different locations-- who's using, or using energy more efficiently, or wasting energy-- in the software, you have the ability to normalize for outside temperature, or for square footage, things like that.

So we have a lot of customers, retail chains that they might have 300 stores around the country. And you say, well, of course in Florida they're using a lot more HVAC in the summertime than the folks in San Francisco. But all of a sudden, you start to normalize it for temperature, and you realize wait a minute-- San Francisco store's using more energy for some reason. So I might want to focus my attention there.

And then I can drill down-- is it in their HVAC? Is in their lighting? Is it in their machinery? And you start to identify where that's coming from. So yeah, you can take in some other types of information and systems. Our company in particular, we're going to start working with gas, and water, and steam as well with sensors. We don't have that out now. But that's on our road map as well. We're getting that from a lot of customers that that's important to have it in one system. Yeah.

AUDIENCE: Could you perhaps [INAUDIBLE] connect all the information from some source [INAUDIBLE] social media, but [INAUDIBLE]

DENNIS PLATT: Yes. So for us personally, our software has an open API, so if you want to bring that data into

another system that you already have. We also have our next generation gateway, or bridge. We'll have a connector to go like a Modbus port, so you can connect into another system. So you can get to the point where we don't want to be a controls company. That's kind of not what we're looking to do as a company.

But a lot of people, a lot of customers, are saying, well, the sensor is telling me that my parking lot lights are on in the middle of the day. And so I have to send that notice to somebody, and somebody has to go check the BMS system and see if that's the case, and why was it set wrong, and they have to change it. So they've asked us to be able to just make that connection for them to say, hey, it's 1 o'clock in the afternoon and my parking lights are on. Tell the BMS system to turn them off.

But somebody's still going to have to do some programming there, right? But it's the good and the bad with a BMS system is that it's all automated. That's the idea-- you program it, and it works. But we all know, you drive through a city at night, and you see half the high rises are all lit up. And if you ask the building manager, they'll say, oh no, we turn our lights off at night. Now they leave some on-- there's cleaning and this and that.

But the reality is HVACs are running, lights are running, but they say the BMS is set. Well the sensors will tell you that they're not, and so it's just a simple correction. But if you're not there, you're not going to know about it. Yeah. Does that answer your question? OK. Move on? Oh. Go ahead.

AUDIENCE: [INAUDIBLE] worked in Europe?

DENNIS PLATT: In Europe? Yes.

AUDIENCE: Doesn't matter?

DENNIS PLATT: No, doesn't matter. Yeah. Good question, though. Thank you. Yeah we're actually installed in about 30 countries around the world. Yeah. So kind of to your question a little bit, but yeah, taking the sensors and integrating with other systems out there as well and using that data. Crossing. So we don't want to be a siloed solution, and as the internet of things, that's the whole idea is everything being connected. And that's where it's going. It's not such a common platform right now, but I think most companies are trying to be open in order to do that. And so we've worked with some of these already.

So in conjunction with Autodesk and, well you guys are all here, we do work with Building Ops,

so as a work order management system with Building Ops specifically, so when the sensor detects something going on with an asset, it can automatically send that notification to Building Ops, which will create a ticket and send it to their facility or maintenance people kind of like what we are talking about.

And so I think Building Ops is-- some of this is still free download. I probably shouldn't say that because I don't know for sure, but I know it was. But anyway, so there's that connection available. So Building Ops has a mobile app as well, and you can connect through there to get the same kind of data and get the work order started.

Questions? Yep.

AUDIENCE: [INAUDIBLE]

DENNIS PLATT: Yes. Yes. Is anybody using Building Ops in here now? Are you using Building Ops? No. Anybody? Wow. OK. Shh, don't tell Autodesk. So a couple of different sides and some screenshots of what that looks like, but the cool part is that when the sensor detects something going on and it sends a ticket into Building Ops, then Building Ops actually has the ability to pull up the information on the asset. So it's a Carrier rooftop unit or I don't know what that is over there. I can't see it.

But whatever that device is-- the manufacturer, the warranty, all the information you can get right there, so if you're going out to fix it or look at it, at least the technician has an idea before he goes out there of what they're going to look at. And they may already know, yeah, we continue to have a problem with that, or it's probably going to be a filter, or you know whatever. So their time is being more productive as well when they're out there looking for these.

And then just some of the key points we kind of talked about. Just having that integration is giving people the right information at the right time, but it's really about having the insights into it. Question.

AUDIENCE: So is that something that's a progression that's set in some sort of management tool? Or [INAUDIBLE] through the sensor, or is it something that's set in Building Ops, so you can kind of trigger that [INAUDIBLE]

DENNIS PLATT: Yeah, so you can set it in panoramic to say that-- I think like I said before, this should work

within this parameter per the manufacturer's specs. And if it's ever outside of that, then send the alert. And that alert's going to trigger Building Ops to create the ticket. Yeah. And that's all. Pretty straightforward. Questions. Here we go.

AUDIENCE: Do you have some [INAUDIBLE] information from panoramics [INAUDIBLE]

DENNIS PLATT: Do we have some information?

AUDIENCE: [INAUDIBLE]

DENNIS PLATT: Do I have some with me?

AUDIENCE: [INAUDIBLE] .

DENNIS PLATT: No, I don't have anything to show right now. Is that what you meant?

AUDIENCE: Do you have integration [INAUDIBLE]?

DENNIS PLATT: Yeah, we have the integration stuff. Yeah, we can send you that, if you give me your card or something. I can get some information. Yeah, for sure.

AUDIENCE: Just in case of-- this is your software just sending a ticket? Or can I measure-- can I see the extra data once [INAUDIBLE]

DENNIS PLATT: Yes. Both. That's a problem. I apologize because I'm not sure in Building Ops how much of the detail you can see behind the ticket, but through the panoramic system, you can see all the detail. So yeah, I apologize because I don't know how much Building Ops is visualizing of the behind the scenes or the history of it.

AUDIENCE: So it's also on an iPhone [INAUDIBLE]--

DENNIS PLATT: Right. Yeah. So yeah-- I just put my phone away-- but yeah, it's just an app that you can download, or you can view it on a computer as well. Just anywhere you have a log in. But you can look at the energy pattern in history as far back as you have the sensors installed. It's almost like a stock ticker tape to be able see what's going on. There's also a ton of other reports and information you can get from it that's probably outside of Building Ops. So Building Ops is really to create the ticket and get the notification out into the hands of the people that need it. And then within panoramic, you can slice and dice and get a lot of great data behind the scenes. Yeah.

AUDIENCE: [INAUDIBLE] too?

DENNIS PLATT: It's what?

AUDIENCE: [INAUDIBLE]

DENNIS PLATT: Yeah. Yeah, yeah, yeah.

AUDIENCE: Are you using this for performance contracts and stuff for verifying savings, or [INAUDIBLE] happy with the [INAUDIBLE]

DENNIS PLATT: People do use it for that. We tend to believe that it's more of a longer-term solution. So a lot of people use it for [INAUDIBLE] cases. But if you're going to install the sensors, they're pretty inexpensive. And if you find out that something worked, then you'd want to continue to monitor it if it was worth checking once. Just like us, I don't go to the doctor once, and I got a clear checkup, so I don't have to go the rest of my life. Chances are, a piece of machinery is still going to fail at some point. So it's better to know about it beforehand, but you can do it either way.

AUDIENCE: But you're coming up with a dollar value. If you fix something or you identify a problem, you replace something--

DENNIS PLATT: Yeah, so in the software you can put in all the--like your utility information as well. So you would know that-- the software would tell you, well, if you continue running this, or like I could tell you last night how much money we wasted at our facility because all the stuff was left on. And if I would have turned it off, I could have saved x amount. Yeah. And you would get that in the software. Right here.

AUDIENCE: I'm an architect, and I just decided to come in and listen.

DENNIS PLATT: Thank you.

AUDIENCE: What are the kind of things-- I went to one similar class on a little bit about Internet of Things and interconnectivity. I'm interested in knowing what we as an architectural firm can do to ramp up as the clients are going to want models, and they're going to start to want to pump things into this. Is there any connection, anything that we as an architect can do to prepare for Internet of Things and for these types of systems?

DENNIS PLATT: Probably right now it's probably the awareness. I mean what you're doing is great just to know

about it and hear about it because it's probably going to come back to you from the owner's side and the client side is, hey, you designed all this and it's great. But how are we going to manage and monitor this moving forward? So somewhere, those are going to meet in the middle. And you're going to be saying, hey, you guys should be looking at this, because when the building gets turned over and now you're in control of it, you're going to want to know these things. And we can tell you how you might be able to do that.

And it's coming back the other way, because we're getting the knock on the door from the customer saying, hey, we need to monitor or manage these things. And the next building we build, how do we get this in there from the beginning, right? And so then we come back to you guys and say, hey, can you guys design this, inspect this out to know what's coming? So there's still some disconnect, but it's starting to merge in the middle there. But I think awareness for all of us is-- it's just ever-changing. So it's hard to stay on top of. Yeah.

AUDIENCE: So, from what you're saying so far, who's taking initiative to actually install the sensors and set up the systems? Is it really the end users of the equipment, or are manufacturers pre-installing sensors and telling customers, hey, this is already ready to hook up to x system you might have in order to monitor it?

DENNIS PLATT: I mean, I wish I could say there's a-- is everybody hearing in the questions? But I wish there was like a silver bullet answer to that. And unfortunately it's not because I think of how new it all is. It's coming from a lot of directions. And like any technology, it's the early adopters and people who get it who understand that, yeah, if I start doing this now and make a small investment in some of this visibility and insight, what are my savings going to be down the road, right?

So I invest some dollars today, but it might be two years before a major piece of equipment goes bad. But if I knew that ahead of time, how much am I going to save at the end? So it's coming from a lot of directions, kind of like his question as an architect-- where do I start and where does the customer finish? It's coming from a lot of angles right now. Sorry it's a vague answer, but if I had the silver bullet, it would be great for their company because we'd know where to go. But it's coming all over. Right behind you.

AUDIENCE: Is the majority of business existing buildings, or do you also do [INAUDIBLE] new construction? And if so, how much?

DENNIS PLATT: Yeah, the majority is existing. But new construction is starting to grow more and more. There are other options out there for new construction with some of the panel manufacturers and things like that. They are putting this technology already in. A lot of feedback we get is it's just really expensive. And so it just depends where the threshold is for the building owner and how much cost they want to put into that. I would say long term, to me that would be the ultimate way to go when they're ready to bring those costs down. But any kind of retrofitting, it's pretty cost prohibitive to do it that way, and the sensors are just so easy and quick to install, it's that's kind of a no-brainer. Other questions?