AUTODESK UNIVERSITY

IoT 5637

Getting on the Fast Track to IoT

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Learning Objectives

- Understand what components and partners make up a connected product ecosystem
  - protocols
  - devices
  - communications
- Learn how to navigate the world of devices and find what's right for you
- Learn how to identify important considerations when connecting your device to your business systems
- Learn how to prepare an outline for your business application

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Description

This class is designed to take you from zero to IoT (Internet of Things) in 60 minutes. We'll talk about the layers of connectivity and components that make up a complete connected solution – selecting the right devices, protocol, edge systems, and communications, then connecting the data with business logic in Fusion Connect. We aim to provide you with the information you need to build a solution outline that avoids the potential pitfalls and rookie mistakes that come with creating your connected products. This session features Fusion Connect.

Your AU Expert(s)

Lona Dallessandro leads business development activities for Autodesk IoT products. In this role, she is focused on building strategic relationships for Autodesk and its customers throughout the IoT ecosystem, including hardware, Internet access technologies and software integrations. In her career as an executive for both startups and Fortune 100 companies, she has successfully created markets for emerging Internet and software technologies – securing more than $50M in new business for her teams. Lona holds her MBA from the University of Phoenix and her BS in Biological Science from Penn State University.

An Outline for Building Your Fusion Connect Applications

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FUSION CONNECT

Example Pre-Workshop or Pre-Solution Requirements

1. PURPOSE & DATA COLLECTION TECHNOLOGY

Describe the overall IoT / M2M project objectives. Also provide a description of the gateway/controller or PLC being used including make and model. Please explicitly outline how you plan to securely get the data on to the public Internet. Autodesk DOES NOT provide any software for your machine. Fusion Connect receives data at our IP addresses, or Fusion Connect can poll the IP address of a machine or send a file (i.e. firmware) to a machine. You are responsible for writing the software that goes on your machine or device, or you can request assistance from an Autodesk Partner.

This document will provide a guide for the kinds of data required to start a project, using a hypothetical scenario of a harvesting machine used in agriculture. The Autodesk team needs a complete profile in order to conduct a solution workshop or start an application solution.

2. CUSTOMER AND DISTRIBUTOR MANAGEMENT

Please provide the business entities – GROUPS, DEPARTMENTS, DIVISIONS, LOCATIONS, SITES, etc. – that you will use to manage your products and assets.

Machines will belong to Locations that are a hierarchy below Customer.

MACHINE GROUPING	FIELD (REQUIRED)	FIELD TYPE (OPTIONAL IF YOU KNOW)
Customer	Customer Name	Text
	Headquarters Address	Street, City, State, Country, Postal Code
	Contact Name	Text
	Contact Phone	Phone Format
	Contact Email	Email Format
	Customer Start Date	Date Format
Location	Site Name	Text
	Site Address	Street, City, State, Country, Postal Code
	Site Contact Name	Text
	Site Contact Phone	Phone Format
	Site Contact Email	Email Format

Anything can be included in the business entity hierarchy. Please let us know if you need to include distributors and any security/privilege levels between these business entities.

3. PRODUCT / ASSET DATA FIELDS COLLECTED (Phase 1)

Data from the machine will be received in _____ different messages, received every _____ seconds. The size of each message is _____ (KB / MB). The ___ protocol will be used and data will be ____ (text, binary, etc.).

IT IS EXTREMELY IMPORTANT YOU PROVIDE AS MUCH DOCUMENTATION AND DETAIL ON YOUR DEVICE/GATEWAY TECHNICAL SPECS AS SOON AS POSSIBLE, SO OUR SERVICE TEAM KNOWS WHAT TO EXPECT AND CAN SUPPORT YOU. AUTODESK DOES NOT PROVIDE EMBEDDED SOFTWARE, FIRMWARE OR AGENTS FOR YOUR MACHINE OR GATEWAY.

Product Monitored (You Can Categorize the Data if Desired)	Data Fields	Field Type	Operating Range	Alert Level (is there a threshold that is interesting to you, please provide detail)	What is the name of the field on the machine or gateway?
Harvester	Device ID	Text			EXAMPLES BELOW FROM A HARVESTING MACHINE
	Model #	Text			
	Customer Asset ID/Name	Text			
	CTM Serial #	Text			
	Engine Type	Text			
	Engine Serial #	Text			
	Date Purchased	Date Range			
	Warranty Start Date-Engine	Date Range			
	Warranty End Date-Engine	Date Range			
	Warranty Start Date-CTM	Date Range			
	Warranty End Date-CTM	Date Range			
Harvester Machine Data	Suction Fan – Pump 1	Units / PSI	0 - 5000	3500 or >	J1939_CTM_PUMP_1_PRESSURE
	Head Conveyor – Pump 2	Units / PSI	0 - 5000	3500 or >	J1939_CTM_PUMP_2_PRESSURE
	Shaker Head Speed	Units / RPM	0 - 500	400 or >	J1939_CTM_SHAKER_RPM
	Chopper Speed	Units / RPM	0 - 2500	1800 or >	J1939_CTM_CHOPPER_RPM
	Hydraulic Oil Temp	Units / Fahrenheit	0 - 300	250 or >	J1939_CTM_HYD_OIL_TEMP
Harvester - Engine Data	Status	Text: On or Off			"On" if Engine Speed >800; "Off" if < 800
	Engine Hours	Units / Hours			J1939_247_TOTAL_ENGINE_HOURS
	Battery Voltage	Units / Volts	11 - 15	< 11 or > 15	J1939_158_KEYSWTICH_BATT_POTENTIAL
	Engine Speed (1)	Units / RPM	0 - 2500	> 2400	J1939_190_ENGINE_SPEED
	Engine Speed (2)	Units / RPM	0 - 2500	> 2400	J1939_190_ENGINE_SPEED
	Load	Units / Percentage	0 - 100		J1939_92_ENGINE_PERCENT_LOAD
	Coolant Temp	Units / Fahrenheit	0 - 300	225 or >	J1939_110_ENGINE_COOLANT_TEMP
	Oil Temp	Units / Fahrenheit	0 - 300	260 or >	J1939_175_ENGINE_OIL_TEMP
	Oil Pressure	Units / PSI	0 - 80	60 or >	J1939_100_ENGINE_OIL_PRESS
Harvester - Fuel Data	Total Fuel Consumed	Units / Gallons			J1939_250_TOTAL_FUEL_USED
	Fuel Temp	Units / Fahrenheit	0 - 300	250 or >	J1939_174_ENGINE_FUEL_TEMP
Harvester-Map	Location/Latitude	Latitude			GPS_LATITUDE
	Location/Longitude	Longitude			GPS_LONGITUDE

4. ANALYTICS & REPORTS

Reports will show the current operating conditions of the Harvester by displaying all of the data fields collected from the Acme Ceulluar Gateway installed on the harvester, plus some additional data fields manually entered into the application when a Harvester is deployed. These reports should provide views of the Harvester's details and current operating statistics using table reports, graphics, and maps. An Exception report should show any values that are not within the operating ranges defined above. In addition to the automated data collection, a job summary report should show the details of a job performed when a row of tomatoes is harvested. These reports are defined in the table below.

Please provide as much data on analytics, calculations, business rules and business logic that drives the creation of any of these reports. If there are any visuals desired, please provide a separate PPT or similar file with your desired solution pages/views.

Report Name	Data Fields	Search Criteria	Description or Calculation or Business Rule that Drives the Report
Harvester Details	• Customer (Asset Owner) • Location (Asset Location) • Asset ID/Name • Model # • CTM Serial # • Status (Engine On/Off) • Engine Type • Engine Serial # • Warranty Start Date-CTM • Warranty End Date-CTM	All searching of all fields	Displays the information in "real time" about the Harvester and it's current state if possible (On or Off)
Engine Details	• Customer • Location • Asset ID/Name • Engine Type • Engine Serial # • Engine Hours • Warranty Start Date-Engine • Warranty End Date-Engine • Oil Pressure	Location, Asset ID, Engine Type, Engine Serial #, Warranty Start/End Dates	Displays information in "real time" specific to the Engine on the Harvester
Machine Data	• Location • Asset ID/Name • Suction Fan – Pump 1 • Head Conveyor – Pump 2 • Shaker Head Speed • Chopper Speed • Hydraulic Oil Temp	Asset ID	Displays information in "real time" about the status of the equipment installed on the Harvester
Engine Data	• Location • Asset ID/Name • Engine On or Off • Engine Hours		

	• Engine Speed (1) • Engine Speed (2) • Battery Voltage • Load • Coolant Temp • Oil Temp • Oil Pressure		
Fuel Data	• Location • Asset ID/Name • Total Fuel Consumed • Fuel Temp • Fuel Consumed per Eng Hour	Location, Asset ID	Displays information in "real time" about the status of the fuel on the Harvester. Fuel Consumed per Engine Hour is a Phase 2 item.
Harvester Location	• Location • Asset ID/Name • Show Icon on Map	Location, Asset ID	Displays information in "real time" about the location of the Harvester by displaying on a map. Show Harvester Details if click icon.
Show in Gauges/Gadgets	• Total Fuel Used • Engine Oil Temp • Coolant Temp • Fuel Temp • Oil Pressure • Hydraulic Oil Temp • Suction Fan • Head Conveyer • Shaker Head • Chopper • Engine Speed 1 • Engine Speed 2 • Engine Hours • Battery • Load		Displays all of the active data fields receiving information in "real time" via a graphical display.
Exceptions/Alerts (Real Time)	• Customer • Location • Asset ID/Name • Event Type (Any data field with a range set above) • Timestamp • Data value (if not within range or if at alert level)	Customer, Location, Asset ID, Event Type, Time stamp	If any of the data fields above our reporting a value not within the range (Alert levels) when received report the Event Type (i.e., Engine Temp, Oil Pressure, Engine RPMs, etc..)
Daily Exception Report	• Customer • Location	NA	Send an automated report daily to a distribution list to be

	• Asset ID/Name • Event Type (Any data field with a range set above) • Timestamp • Data value (if not within range or if at alert level)		emailed. Send 24 hour snapshot of all Exceptions by Asset ID.
Exception Summary Report	• Customer • Location • Asset ID/Name • Total # of each Event Type over period of time selected	Customer, Location, Asset ID, Date Range, Event Type	User can run a report based on an Asset ID or Event Type to show total # of exception events that occurred over a given time period.
Notifications Sent	• Customer • Location • Asset ID/Name • Timestamp • Distribution List recipient • Event Type (Any data field with a set range can have notification) • Data value (if not within range or at alert level)	Customer, Location, Asset ID,	If any of the data fields with set ranges above report a value not within the range or at the alert level a notification should be sent for each these Event types (ie., Oil Temp, Engine Temp, etc.)
Rows Harvested	• Customer • Location • Asset ID/Name • Operator • Field Name or Section • Crop Type • Start Time • Stop Time • Rows Completed • Fuel Consumed within Start/Stop		Through the use of a manual input form, enter Location, Asset ID, Operator name, Field Name, Start Time, Stop Time, Rows Completed (this will be simulated for the demo using a form system until more automated way to capture data can be determined)

5. USER ROLES

User Roles required will be Administrator level for Distributor and Customer level for Customer's customers to view data. This information can be gathered after an app is created, but any information you can provide about user roles and privileges will be very helpful.

User	Role	Description
System Administrator	• Manage Users/Roles • View Reports	Administrators will be both Customer level and CTM level with same permissions to edit products and enter any form data required. They should also be able to add users,

	• Manage Resources/Edit Data • Import Data • Submit Forms • Create Distribution Lists	
Customer Administrator	• View Reports • View ALL Customer Locations • Submit Forms for all Locations • Manage Users for Customer	The Customer Administrator will be able to see all users and locations assigned to this customer.
Customer Site Administrator	• Can View Reports at assigned Location(s) only • Submit Forms at assigned Location(s) only • Manage Users at assigned Location(s) only	The Customer Site Administrator will only be able to see users, activities, reports for their assigned location(s).

6. USE CASES

6.1 Exception Event

User: Customer Administrator
Scenario: A harvester is operating with an engine oil temperature of 265 which is above the operating range.
Actions: 1. Exceptions report records the Location, Asset ID, Timestamp, Event Type (Oil Temperature), Value (265 F) for the harvester.
                  2. Notification is sent to the Distribution list for an Oil Temperature Exception (when value is greater than 260 F) and Customer Site Administrator receives email and determines what action to take next.

6.2 Monitoring Event

User: Customer Site Administrator
Scenario: Customer wants to see current status of a Harvester to view if Engine is On or Off, and what the current operating values are for all of the data fields to make sure it is operating within set ranges.

Actions: User will log into the system and click on Report views that show the Engine data and machine data of a particular Asset ID. In order to calculate if Engine is On or Off, the Engine Speed (1) data value will be used based on whether it is below 800 RPMs (OFF) or above 800 RPMs (ON).

6.3 Locate Harvester

User: Customer Administrator
Scenario: Customer wants to find location of a particular harvester and see it displayed on a map.
Actions: User will log into system and click on Locate Harvester to look up the Asset ID and have an icon for the Harvester appear on a map. By clicking on the icon, the Harvester Details will be displayed such as CTM Serial #, Customer, Site Location address, and Model #.

6.4 Warranty Information

User: Customer Site Administrator
Scenario: Harvester is malfunctioning and customer wants to know if it is still under warranty.
Actions: User will log into system and click on Harvester details report to search by Asset ID/Name and see if the equipment is still under warranty from CTM.

6.5 Job Summary (Rows Harvested)

User: Customer Administrator
Scenario: Customer wants to know how long it takes a harvester to complete a row of harvesting at a certain location for a certain crop. The operator must enter data in order to capture the field name, start time, stop time, and type of crop harvested.
Actions: Operator will enter fields using a smartphone or device installed on harvester that allows him to enter the following fields into a web-based form (Phase 1):
- Asset ID
- Operator Name
- Field Name
- Crop Type
- Start Time
- Stop Time
- Quantity of Rows Harvested

6.6 Exception Summary

User: Customer Site Administrator
Scenario: Customer wants to know how many exceptions occurred over a given time period for a particular Asset ID.
Actions: User will log into system and run an Exception Summary report and enter the Asset ID they want to research and a date range. The report will show the total number of Exceptions (events where values are outside the designated operating ranges) for the Asset ID as well as the total number of each type of Exception (Event Type) for that Asset ID for the time frame specified in the search.

7 PHASE 2 IMPLEMENTATION ITEMS

7.1 Failure Code Monitoring and Reporting

In the future, failure codes will be supplied by the machine that will help diagnose a particular problem occurring on the machine. The solutions will need to be able to collect these failure codes and report on them using a separate report with Timestamps for each Failure code and a summary report to show how many times the same failure code occurred within a given time period for a particular asset. There may also be notifications required based on the type of failure code reported.

7.2 Spare Part Visibility

Spare parts for the Harvesters stored at a customer site may need to be tracked using the application to help XYZ's customers monitor On Hand quantities, min/max levels, consumption and replenishment of spares. There will also need to be a connection made between the Asset ID type and what part numbers are used on the asset in order to see what OnHand parts are available to repair the asset. This information is not available in Phase 1.

7.3 Automating Job Input

The customer would like to find a way to automate data collection to record how long it takes to harvest a row or field of tomatoes. Currently, there is no way to know when a section has been completed unless the operator completely turns the harvester off after each job. This is not efficient for operation. A device may be installed in the future requiring some minimal data input from the operator that is combined with automated data collection to record each "job" or "row" or "field" harvested that may even include a scale to weigh how much crop is collected per acre of a field. This will help drive efficiency to know which equipment and operators are outperforming others for comparison purposes.

7.4 Calculating Daily Fuel Consumption

Data is collected on how many gallons of fuel are consumed cumulatively but to compare efficiency from day to day a report should be collected from the machine to determine how many gallons per Asset ID are consumed per Engine Hour. This will help customers understand what the fuel efficiency is of a harvester and compare from one location to another. Currently this data has not been implemented on the machine.