#### **MICHIGAN STATE** UNIVERSITY **Project Plan Presentation** SmartSat<sup>™</sup> Software Development Kit & Al Platform **The Capstone Experience** Team Lockheed Martin Space **Tyler Holt Jackson Haugen Robert Francis Kyle Soderlund** Kurt LaBlanc MaxwellLu

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...to Professionals

#### **Project Sponsor Overview**

- Lockheed Martin Space is our project sponsor
- Products include satellites, space probes, missile systems, and components of NASA's Orion spacecraft
- Produce software to be executed on their line of satellites and ground to support the on-orbit satellites

## **Project Functional Specifications**

- SDK manager changes three-format system to a single operating system agnostic format
- Built in tools to handle versioning and dependency chains
- Query functionality
- Users can publish their own SDKs
- Allows deployment of AI/ML models to SmartSat<sup>™</sup> applications
- Increases compatibility and speed of SmartSat<sup>™</sup> AI services

### **Project Design Specifications**

- Users can filter SDKs by properties
- Users can select the directory where they would like to place the SDK
- Users can create and publish their own SDKs
- Users specify the host and target architecture and operating system
- ML model compiled with Python module
- Inference engine runs on SmartSat<sup>™</sup> devices

#### Screen Mockup: SDK Installer/Uploader

F	Available SD	Ks			SDK Creator Tool
Name	Status	ITAR	Info	49	Create New SDK
sat-nav-sdk	Not installed			Ξ	Hast Architechture:
gps-lock-v3	Installed				Host Operating System:
sat-engine-sdk	Installed				Target Architechture:
smart-sat-sdk	Not installed	Δ			Target Operating System
					SDK Name:
Filter by: 🗍 Name: 🕅	•	ersion:		2	Create from Existing SDK Existing SDK Name: Change Host Architechture: Change Host Operating System: Change Target Architechture: Change Target Operating System:
C Architecture:	♥ □ 05:	¥ O Expo	t Controlle	ed	New SDK Name:
beict	all Univ	estall			Install Publish
					In a second s

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#### Screen Mockup: SDK Installer Pop-up

•	SmartSat SDK	Manager - Installation Tool	
	Select Install Directory:	1	]
		Install	

#### Screen Mockup: SDK Package Installer

Return to SDK Installer	Ava	ilable Pack	ages		
	Name	Status	Version	Info	
	sds-core-doc	Installed	3.0.1	×	T
Salast Level SDK	sDundee-linux	Not installed	2.0.0	×	T
Select Local SDK	vxsim-smp-2022	Not installed	3.0.0		
Local Directory Name:	sds-core-vxsim	Not installed	1.0.2		
Replace/Update Packages	vxsim-smp-2021	Not installed	0.1.1		1
Host Architecture:	sDundee-linux	Not Installed	1.7.0		
Host Operating System:	ubuntu-focal-0.0.3	installed	3.0.1		
Target Architechture:	dm-compiler	Not Installed	0.0.7	×	
Target Operating System:					
View Available Packages					
	Filter by: 🔘 Name:	V Dv	ersion:	10	¥

## Screen Mockup: Inference Engine Logs

lms-user@lms-bolt:~
lms-user@lms-bolt:~\$ docker logs -f inference-engine
[2023-22-01 15:19:31,089] INFO in process_message: Prediction: small_civ_ship - Confidence: 0.89124
[2023-22-01 15:19:31,087] INFO in process_message: Inference time: 0.0667334
[2023-22-01 15:19:31,152] INFO in process_message: Prediction: barge - Confidence: 0.68322
[2023-22-01 15:19:31,155] INFO in process_message: Inference time: 0.099357
[2023-22-01 15:19:31,268] INFO in process_message: Prediction: military_ship - Confidence: 0.45519
[2023-22-01 15:19:31,275] INFO in process_message: Inference time: 0.0321565
[2023-22-01 15:19:31,301] INFO in process_message: Prediction: small_civ_ship - Confidence: 0.77821
[2023-22-01 15:19:31,303] INFO in process_message: Inference time: 0.0567299

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## **Project Technical Specifications**

- Electron
  - Used to create GUI front end
- Flask
  - Used to create an API to interface with the Electron GUI
  - SQLAlchemy is used with Flask to retrieve requests for data from the MySQL database
- MySQL
  - Contains tables of SDK and other related packages along with metadata
- ONNX Runtime
  - ONNX format is used as the standard for models, ONNX Runtime facilitates inferencing on remote hardware

# **Project Software Architecture**



# **Project System Architecture**



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#### **Project System Components**

- Hardware Platforms
  - UDOO Bolt V8
    - Equipped with an AMD V1000 APU that has Zen CPU and Vega GPU architectures
- Software Platforms / Technologies
  - Electron
  - Flask
  - MySQL
  - ONNX Runtime
  - AMD ROCm

## **Project Risks**

- Risk 1
  - Filtering results in the GUI
  - run conditionals that will check where each file came from
- Risk 2
  - Installing RPM files correctly
  - We will use scripting for each command without the user seeing any code being run.
- Risk 3
  - ROCm versioning and support
  - We see no alternative other than to just push through.
- Risk 4
  - Docker Container
  - We will install Docker Desktop and see what it takes to establish a container on our AMD machine.

#### **Questions?**



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