

AI-Powered Biodiversity Monitoring System

HackHive 2024 - Group 9

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Problem

WE'RE ALL GOING TO DIE!
(yes you!)

03

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How Azure can address
this problem

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Addressable Market

WE'RE ALL GOING TO
MAKE IT!

Team

Fi

Mclaughlin

Noshen

Atashe

Moksh

Bhavsar

Marco

Ma

Clayton

Cotter-Wasmund



02

Problem

THE WORLD IS ENDING

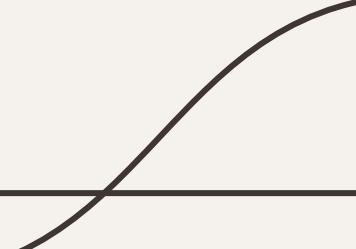
Habitat Loss



Species Extinction



Invasive Species



Ecosystems Are Dying

Large Areas

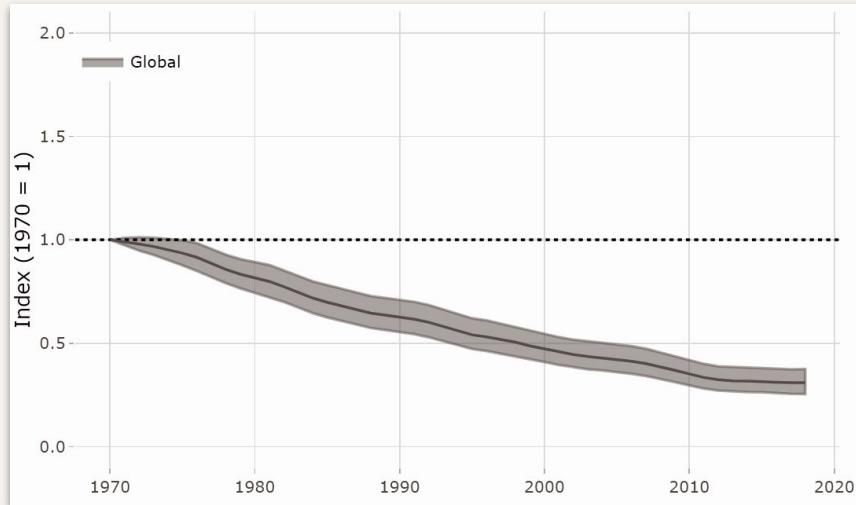
Most ecosystems are too large to survey accurately and consistently.

Wasted Resources

Talented and passionate people are hard to come by, they don't need to be stalled by poor infrastructure and data as well.

Poor Understanding

Poor understanding of data and solutions has led to numerous ecosystem disasters.



Living Planet Biodiversity Index Report
2022, WWF/ZSL

Use Case

Large Areas

- Most ecosystems are too large to survey accurately and consistently
- Transparent data sharing in a visual way encourages community awareness and support

Additional Use Cases

- Environmental Science and Sustainability Promotion
- Education for Private and Personal Use
- Adaptive Infrastructure can be used for low resource areas

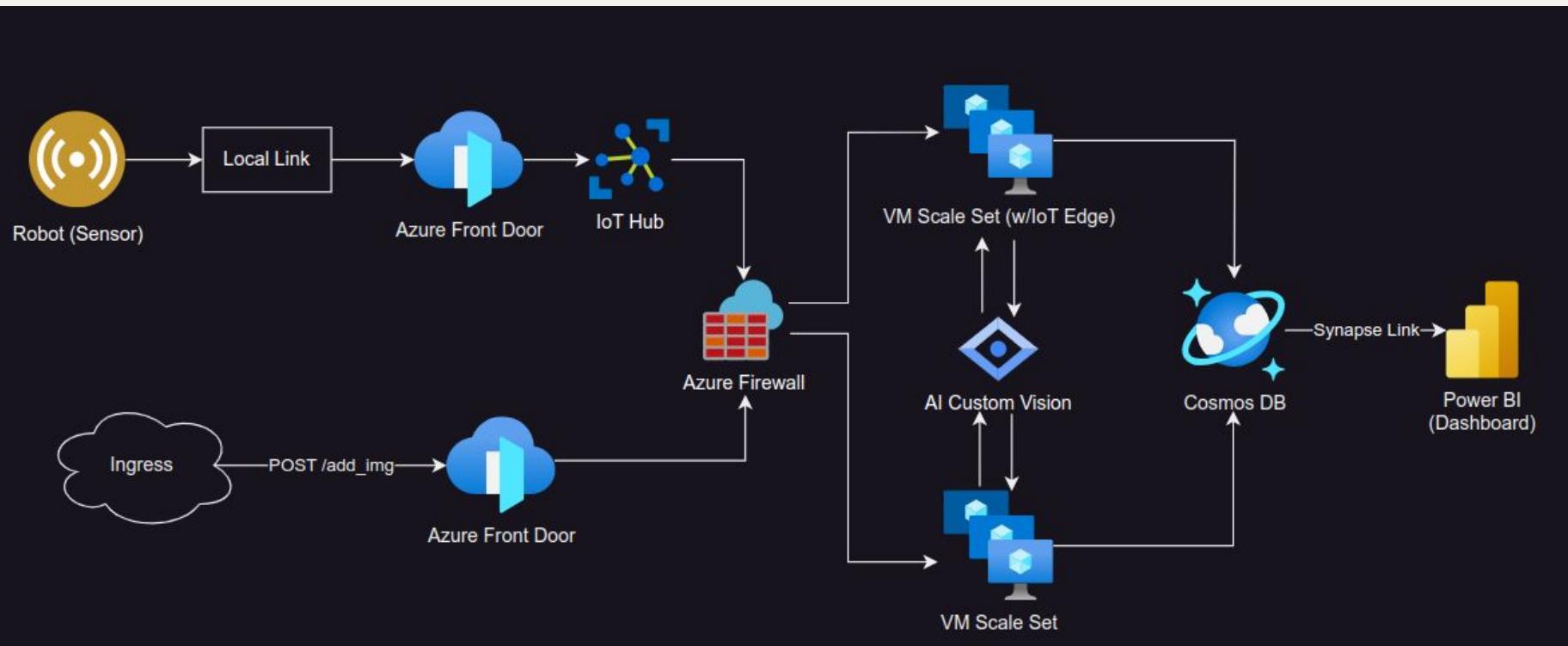
03 Solution

Physical and Virtual Aids & How Azure Can Help

Front-End

- An autonomous robot that has multiple sensors collecting different data metrics
- A Power BI Dashboard that visualizes all the data that we collected including a heat map, filterable data among many other features

Architecture Diagram



Azure Services

- Azure Firewall
- Azure Front Door
- Azure VMSS
- Azure IoT Hub & Azure IoT Edge
- Azure Cosmos DB
- Microsoft Power BI

Disaster Recovery

- Zone Redundancy
 - Azure Cosmos DB, Virtual Machine Scale Set, Azure Firewall, Azure IoT Hub, Power BI*
- Always Available
 - Azure Front Door,

Platform View

Biodiversity Monitoring System

Species1	Pop. in Loc 1	Species2	Pop. in Loc 2
Top and Bottom 5 Keywords			
police	3062	weapons	20
protest	547	stabbing	12
shoot	866	demonstrators	9
shot	1601	street violence	2
steal	649	rioting	1

Word Map Monitor

Invasive Species over Time

Heat Map Pin Map

Species	Location	Rank	Pop.
shot	8	1601	12808
shoot	8	866	6928
police	2	3062	6124
steal	8	649	5192
riot	8	355	2840
smash	8	229	1832
boot	8	207	1656
protest	2	547	1094
armed	9	82	738
Total	154	8163	40928

Bing



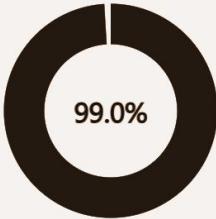
04

Examples

Animal Classification

Dataset of 90 Different
Ordered Species

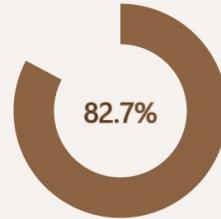
Precision ⓘ



Recall ⓘ



AP ⓘ



Tag	Probability
ladybugs	24%
beetle	18.3%
cockroach	6.8%
fly	5%
bee	3.4%



Tag	Probability
zebra	34.4%
tiger	5.6%
okapi	4.6%
rhinoceros	4.2%
horse	4%

Mushroom Classification



Species	Original	Greyscale	Pixelated Greyscale
Agaricus	97.7%	96.2%	86.8%
Amanita	26.7%	1.2%	2.6%
Cortinarius	0.4%	1.7%	1.2%
Entoloma	0.2%	0.0%	0.0%
Boletus	0.0%	0.0%	0.0%

- Real world ecosystems will have few similar species for each niche. (compared to the total # of active species)
- Test cases work great when there are few numbers of conflicting species, even if aesthetically similar.



Some Notes

Object vs. Species Detection

Object detection hard if subject is <5% of image.

Analyze API detection just needs to detect that SOMETHING exists. Species detection handled by Custom Vision

Biased Datasets

Small & Uneven

Tag	Precision	Recall	A.P.	Image count
Boletus	97.7%	97.2%	99.7%	1071 
Amanita	93.8%	90.0%	97.3%	748 
Cortinarius	91.5%	90.4%	97.0%	834 
Entoloma	86.7%	74.3%	93.2%	175 
Agaricus	70.5%	78.6%	85.0%	351 

Large & Even

Tag	Precision	Recall	A.P.	Image count
zebra	100.0%	8.3%	93.6%	60 
turtle	100.0%	41.7%	99.4%	60 
starfish	100.0%	41.7%	90.9%	60 
snake	100.0%	16.7%	99.4%	60 
sheep	100.0%	25.0%	63.1%	60 

```
"rectangle":{  
    "x":730,  
    "y":66,  
    "w":135,  
    "h":85  
},  
"object":"fungi",  
"confidence":0.501},
```

Some Notes Cont.

The Bird Scenario

Information overloads are bad.

500 bird species with ~150 sample images each.

This is a practical scenario.

Precision ⓘ

Recall ⓘ

AP ⓘ



0.0%

0.0%

0.5%

05

Addressable Market

Major Players &
Cost Analysis



Price Breakdown

Your Estimate

▼ Storage Accounts		Block Blob Storage, General Purpose V2, Hierarchic...			Upfront: CA\$0.00	Monthly: CA\$70.50
▼ Azure AI services		Azure AI Custom Vision, Standard tier: 100 projects,...			Upfront: CA\$0.00	Monthly: CA\$985.66
▼ Azure IoT Hub		Standard Tier, Free: 500 devices, 8,000 msgs/day, \$0...			Upfront: CA\$0.00	Monthly: CA\$0.00
▼ Azure IoT Edge		There are no charges to use Azure IoT Edge.			Upfront: CA\$0.00	Monthly: CA\$0.00
▼ Azure Front Door		Azure Front Door Standard - Base instance included...			Upfront: CA\$0.00	Monthly: CA\$47.81
▼ Azure Firewall		Standard tier, 2 Logical firewall units x 730 Hours, 0 ...			Upfront: CA\$0.00	Monthly: CA\$2,455.08
▼ Virtual Machine Scale Sets		2 D2a v4 (2 vCPUs, 8 GB RAM) x 730 Hours (Pay as you ...			Upfront: CA\$0.00	Monthly: CA\$369.24
▼ Azure Cosmos DB		Azure Cosmos DB for NoSQL (formerly Core), Stand...			Upfront: CA\$0.00	Monthly: CA\$62.85
▼ Azure Front Door		Azure Front Door Standard - Base instance included...			Upfront: CA\$0.00	Monthly: CA\$47.81
▼ Virtual Machine Scale Sets		2 D1 (1 vCPU, 3.5 GB RAM) x 730 Hours (Pay as you ...			Upfront: CA\$0.00	Monthly: CA\$274.97

Support

SUPPORT:

Included

CA\$0.00

Select your program/offer

LICENSING PROGRAM:

Microsoft Customer Agreement (MCA)

[Log in](#) to see your Azure agreement pricing.

Show Dev/Test Pricing

Estimated upfront cost

CA\$0.00

Estimated monthly cost

CA\$4,313.93

Pricing

\$4,313.93

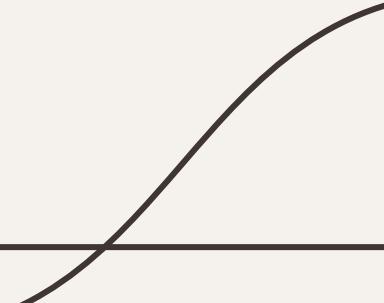
Monthly cost for
Azure Services

\$60,000

Yearly salary of a field
biologist

\$60,000

Yearly cost for Azure
Services



\$1,000,000,000

Pledged By Microsoft's Climate Innovation Fund

Corporate Social Responsibility

Climate impact

Meaningful, measurable climate solutions in the areas of carbon, water, waste, and ecosystems.

Underfunded Market

Investing where the capital need for climate solutions is not being met.

Shared Alignment

Technologies that are relevant to Microsoft's core business and that of our customers.

Climate Innovation Fund

Our \$1 billion investment initiative to accelerate technology development and deployment of new climate innovations through equity and debt capital.

[Read our carbon blog >](#)

Benefits

- Data-Driven Conservation Strategies
- Near Real-Time Alerts and Notifications
- Enhanced Collaboration and Community Engagement
- Reduced Carbon Footprint
- Remote Monitoring and Management
- Predictive Maintenance
- Adaptability to Park-specific needs

Additional Features and Revenue Streams

- DaaS
- Collaborative Research Partnerships
- Public Engagement Initiatives
- API access for third-party
- Grant Fundings and Sponsorships

List of references

Our Git Repository

- [Animal Image Dataset \(90 Different Animals\) \(kaggle.com\)](#)
- [Mushrooms classification - Common genus's images \(kaggle.com\)](#)
 - [Bird Species Classification | Kaggle](#)
- [Classify endangered bird species with Custom Vision - Training | Microsoft Learn](#)
 - [Microsoft | Corporate Social Responsibility](#)
 - [Object detection - Azure AI Vision - Azure AI services | Microsoft Learn](#)

What we have delivered

- Multiple use cases ✓
- Innovative features ✓
- Implemented several azure services ✓
- Architecture diagram ✓
- Platform service ✓
- Functioning code for computer vision ✓
- Cost analysis ✓
- Extensive documentation ✓

Questions

