Mystery Incorporated | DS - 11 Mystery Risks

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James Madison University

"By the time signs and symptoms show [for radioactive and chemical exposure], it is usually too late. To best keep people safe, we must detect first before these agents can cause too much harm."

- JMU Professor, WMD expert

2023 DoD Strategy for Countering WMD

"The United States faces dynamic and evolving WMD threats. The risk of the United States or its Allies and partners facing a military confrontation that includes chemical, biological, radiological, and/or nuclear (CBRN) weapons has increased since 2014."

Limitations

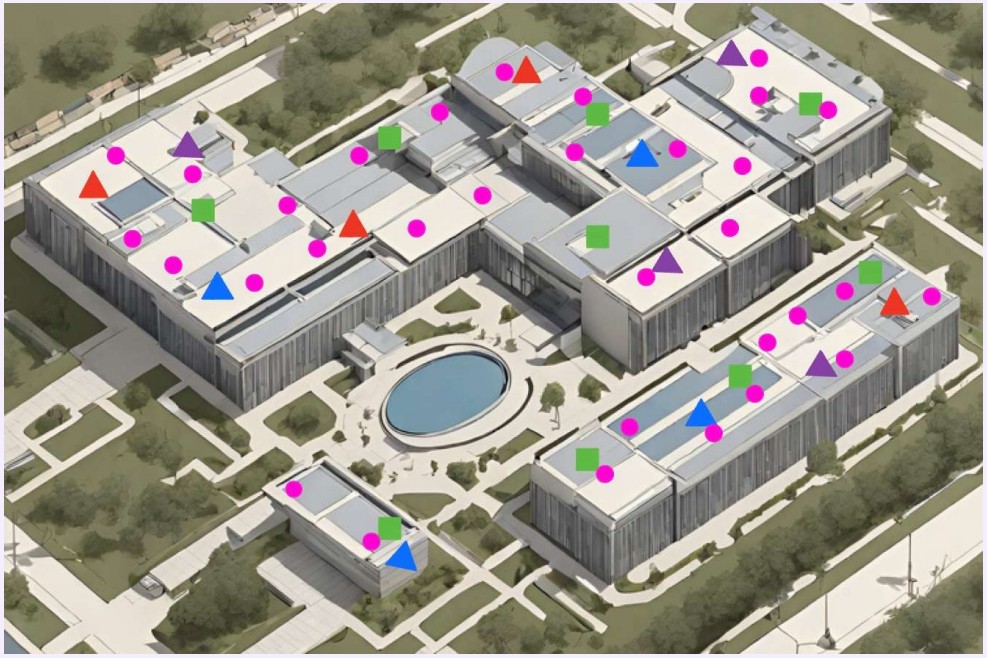
- Consent must be obtained from participating users
- Security risks during data transfer
- Personal Identifiable Information
- Access to devices that are currently being used in embassies

Integrated Agent Detection System

- Radioactive, Chemical, Biological threats
- Using wearable commercial technology to easily and safely collect data
- Integrated Agent Detection System (IADS)
- Expeditionary missions

A Glimpse Into Our Defense

We seek to keep embassy personnel safe from invisible threats. We have created a multi-faceted protocol to alleviate risk using different commercial technologies.



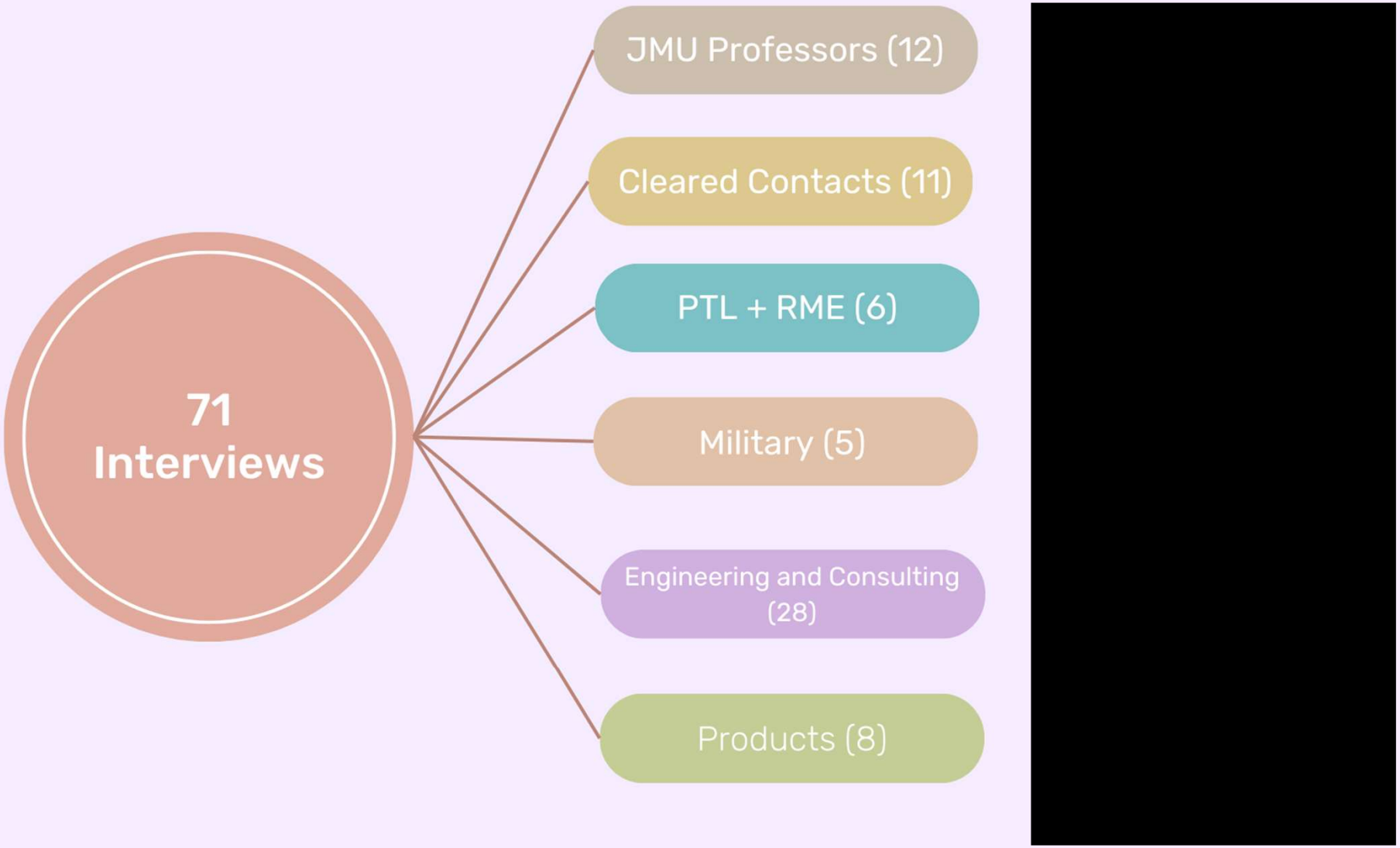
Introducing DS-11: Advancing Embassy Safety Together

Mia Buswell
Junior
International Affairs

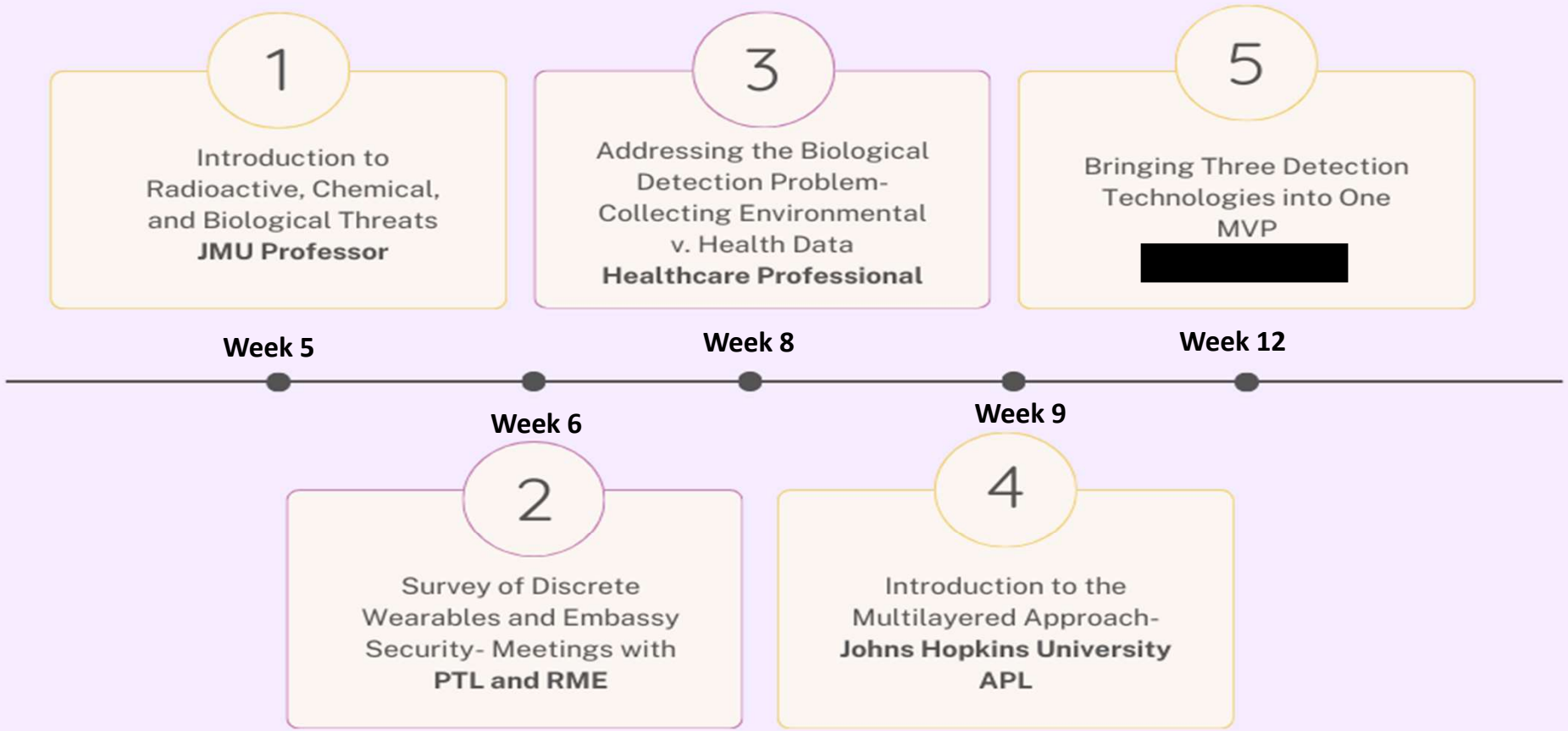
Maxine Payton
Senior
Computer Science

Jocelyn Carter
Senior
Political Science

Alma Cruz
Junior
Mathematics

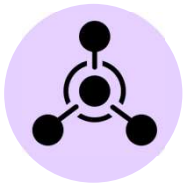

71 Interviews
JMU Professors (12)
Cleared Contacts (11)
PTL + RME (6)
Military (5)
Engineering and Consulting (28)
Products (8)

OUR JOURNEY


1
Introduction to Radioactive, Chemical, and Biological Threats
JMU Professor
3
Addressing the Biological Detection Problem- Collecting Environmental v. Health Data
Healthcare Professional
5
Bringing Three Detection Technologies into One MVP
[redacted]
Week 5
Week 6
Week 8
Week 9
Week 12
2
Survey of Discrete Wearables and Embassy Security- Meetings with
PTL and RME
4
Introduction to the Multilayered Approach-
Johns Hopkins University APL

3 Threat Categories

Radioactive



Chemical

Biological

"Every embassy has to be treated as a potential conflict zone."
- *DOS Security Technical Specialist*

Radioactive

Dosimeters: Instruments for measuring radiation exposure

Active Dosimeters – Radioactive Threats

Polimaster Personal Radiation Dosimeter

- Offline capabilities
- 2-4 Audio-visual alarms
- Currently contracted with DHS and DOE

ThermoFisher Scientific RadEye Personal Radiation Dosimeter

- Alarm system and long-range capabilities
- Natural background rejection technology

Passive Dosimeters – Radioactive Threats

Thermo Fisher Scientific DXT- RAD Extremity Dosimeter

- Passive dosimeters worn by X-ray technicians in embassies
- Worn on fingers and wrists
- Compatible with Thermo Fisher Scientific Harshaw TLD system

Electronic Dosimeter – Radioactive Threats

Radioactivity Counter Smartphone App

- Utilizes Complementary Metal Oxide Semiconductor (CMOS) Sensor
- Sensitive to radiation as low as 10 uGy/h
- Prone to false positives, but effective 'dose warner'

Chemical

Chemical Threats

Smiths Detection ~ LCD 4

- Lightweight Chemical Detector
- Uses non-radioactive Ion Mobility Spectrometry
- Detects nerve, blister, blood, and choking agents and TICs
- Alerts to gas and vapor threats detected at or below immediately dangerous to life and health (IDLH) levels
- Based on LCD 3.3 ~ Chosen by DoD for Joint Chemical Agent Detector Program

Biological

RingConn Smart Ring – Biological Threats

- 7-Day battery life
- Heart rate & blood oxygen saturation
- Skin temperature
- Records trends
- Sleep metrics
- Stress tracking
- IP68 certificated water resistance (50m/165ft)

Scan Watch 2 - Biological Threats

- 24/7 Temperature tracking

- Heart health
  - ECG
  - Daily heart rate & overnight heart rate
  - High & low heart rate notifications

- Sleep parameters
  - Sleep duration
  - Regularity

- Respiratory insights
  - Blood oxygen levels

- Activity tracking
  - Heart rate zones during workout

Minimum Viable Product: IADS

Integrated Agent Detection System (IADS)

Biological Device

Ring Conn

Chemical Device

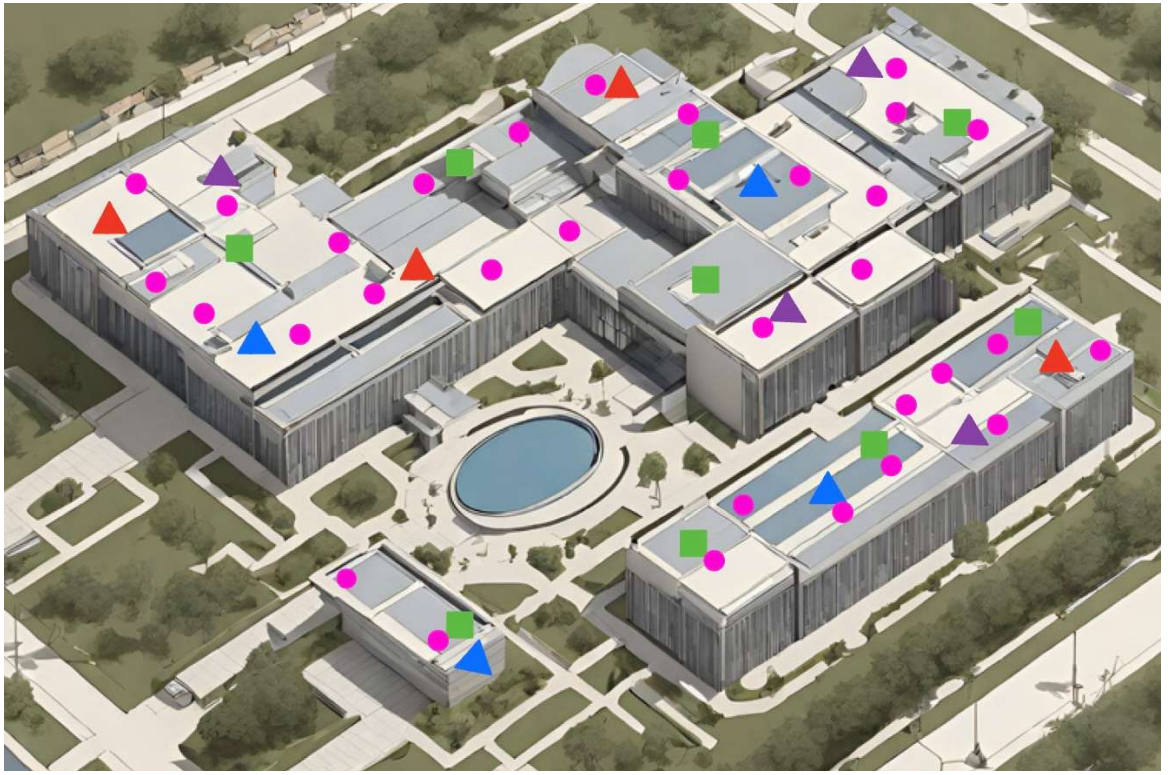
LCD-4

Radioactive Device

CMOS Sensor

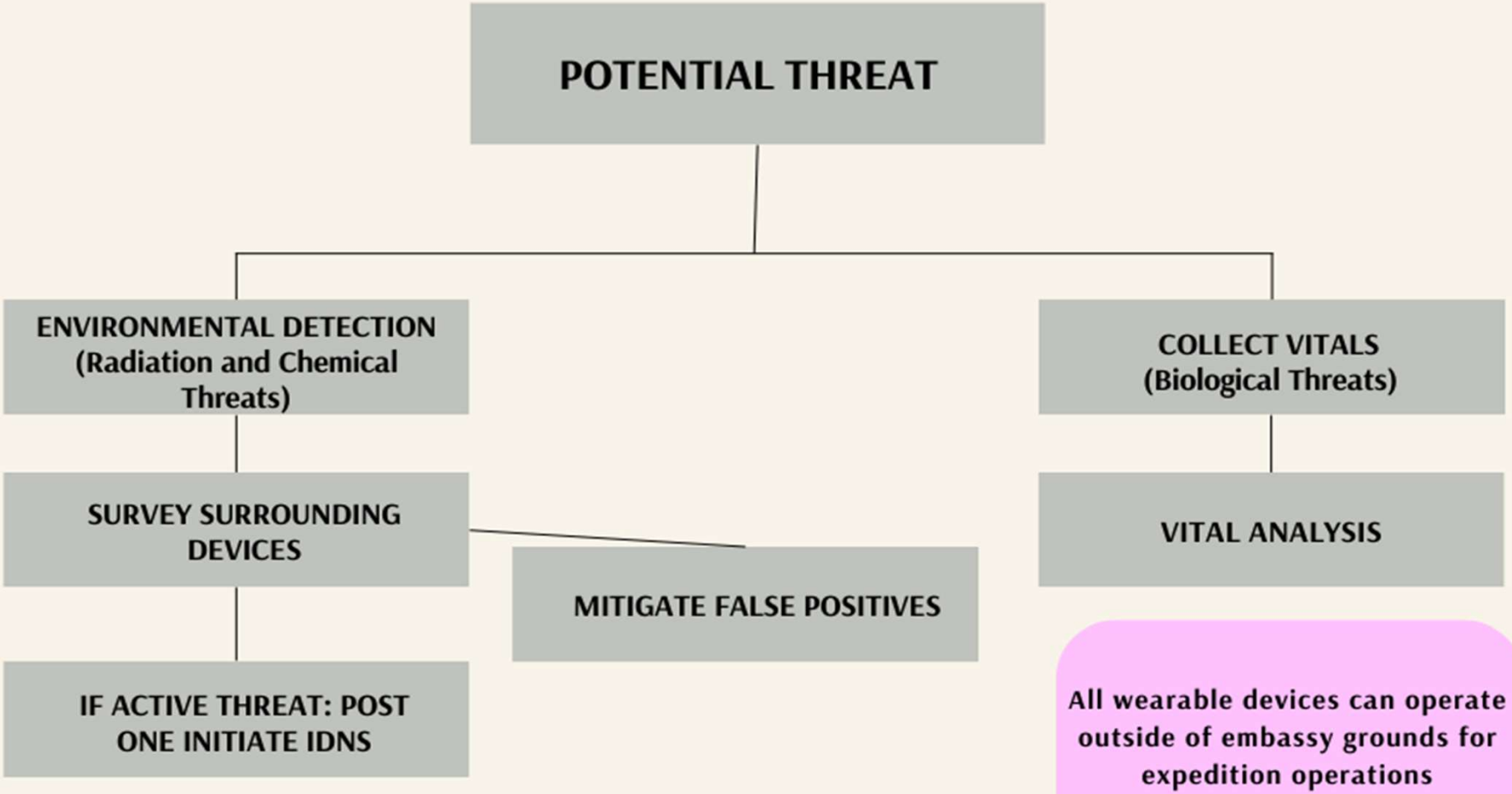
Polimaster PRD
RadEYE PRD

DXT-RAD Extremity
Dosimeter



Integrated Agent Detection System

IN ACTION



Mitigating False Positive Alerts For Radioactive Detection

One Electronic Dosimeter Alerts for High Radiation Levels

Electronic Dosimeter

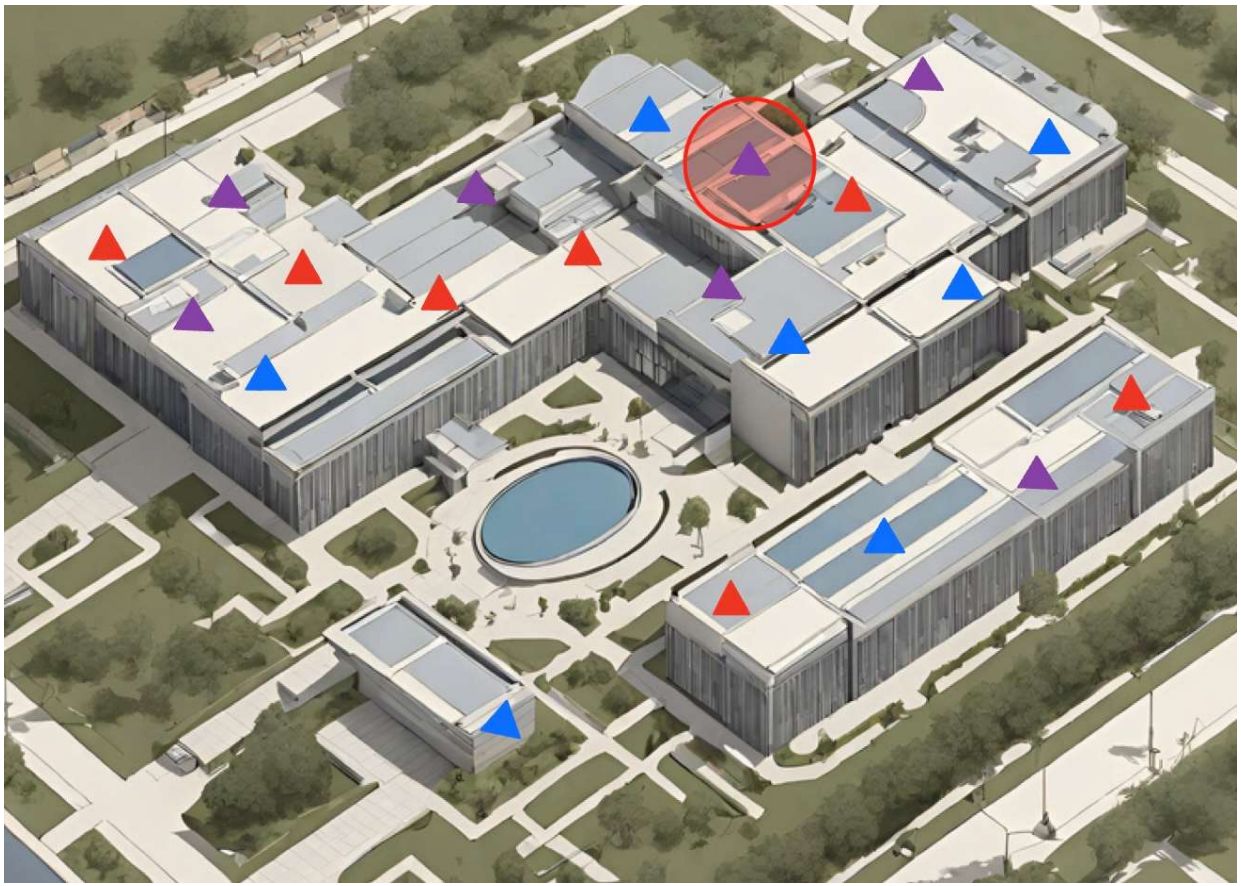
Active Dosimeter

Passive Dosimeter

Dosimeter Alerting

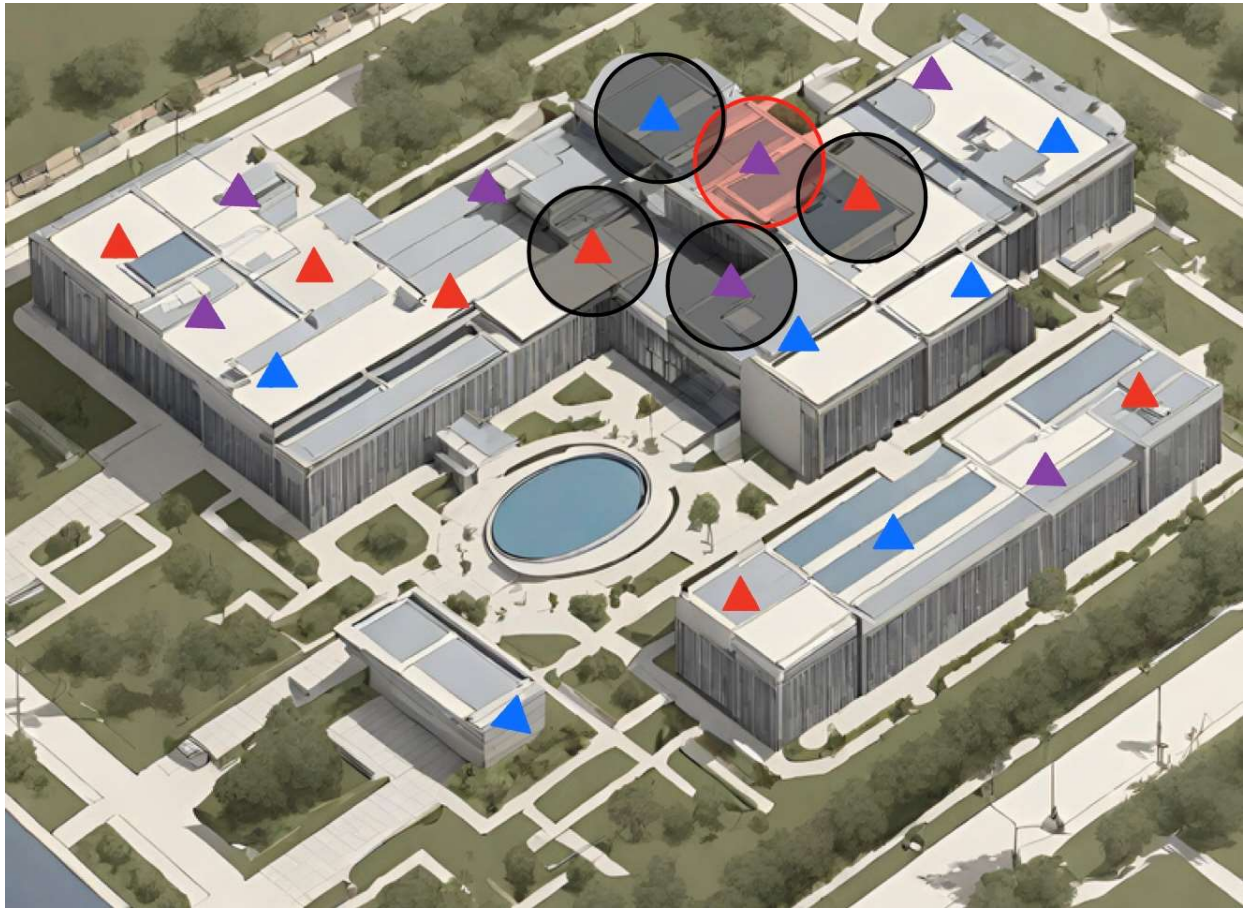
Checking Dosimeter

Cleared Dosimeter (No Radiation Detected)

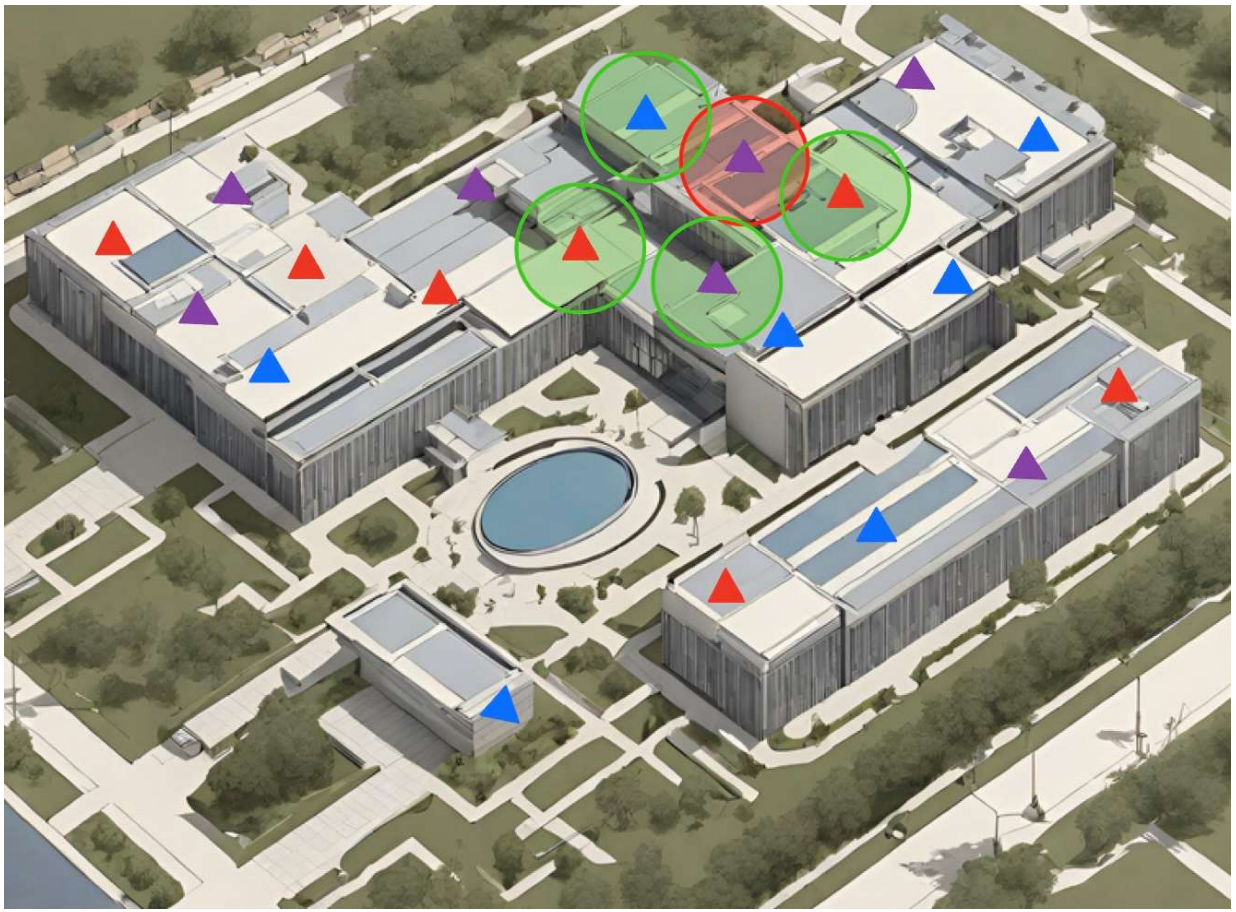


Checking Surrounding Dosimeters

- Electronic Dosimeter
- Active Dosimeter
- Passive Dosimeter
- Dosimeter Alerting
- Checking Dosimeter
- Cleared Dosimeter (No Radiation Detected)



Surrounding Dosimeters - All Clear



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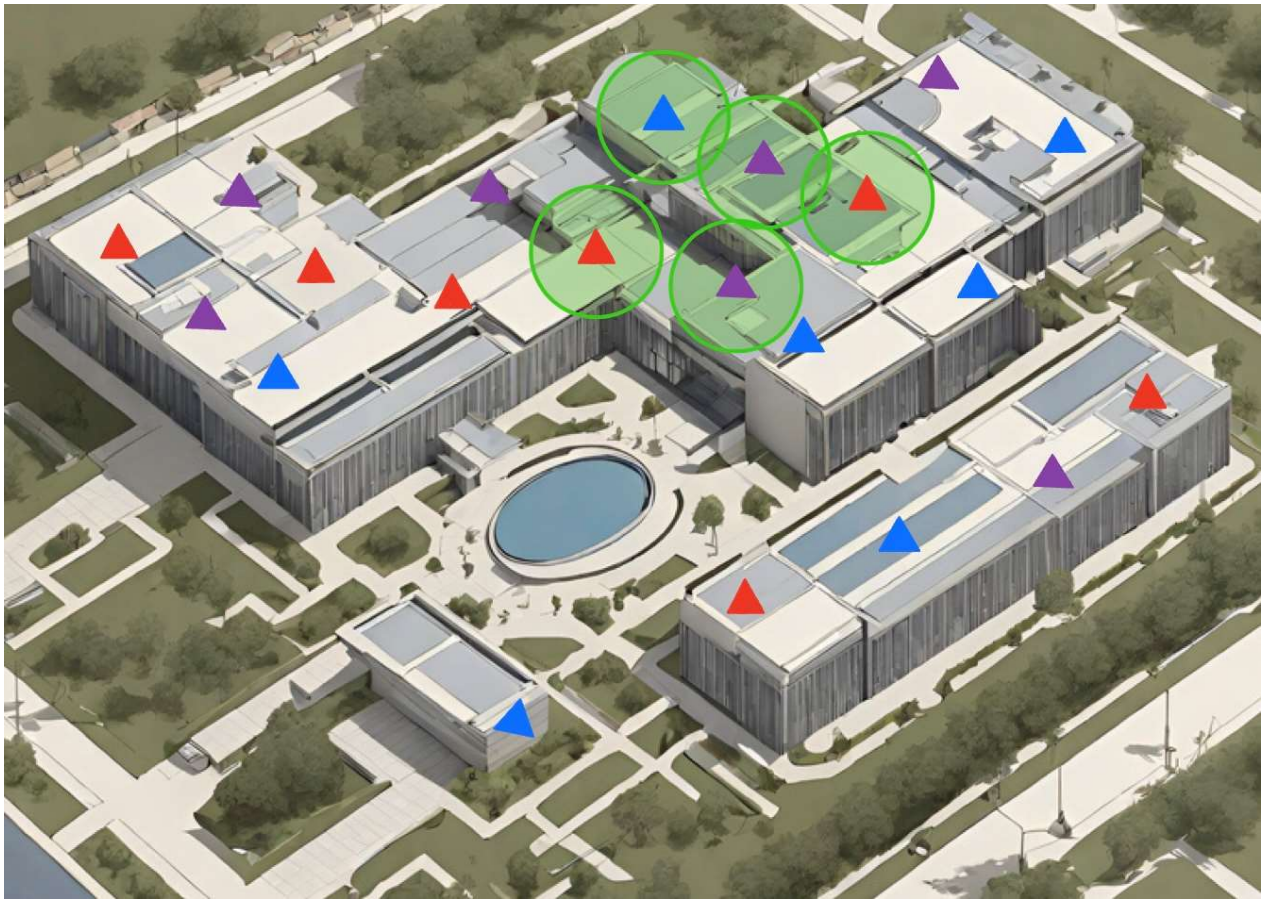
False Positive Mitigated



Electronic Dosimeter

Active Dosimeter

Passive Dosimeter

Dosimeter Alerting

Checking Dosimeter

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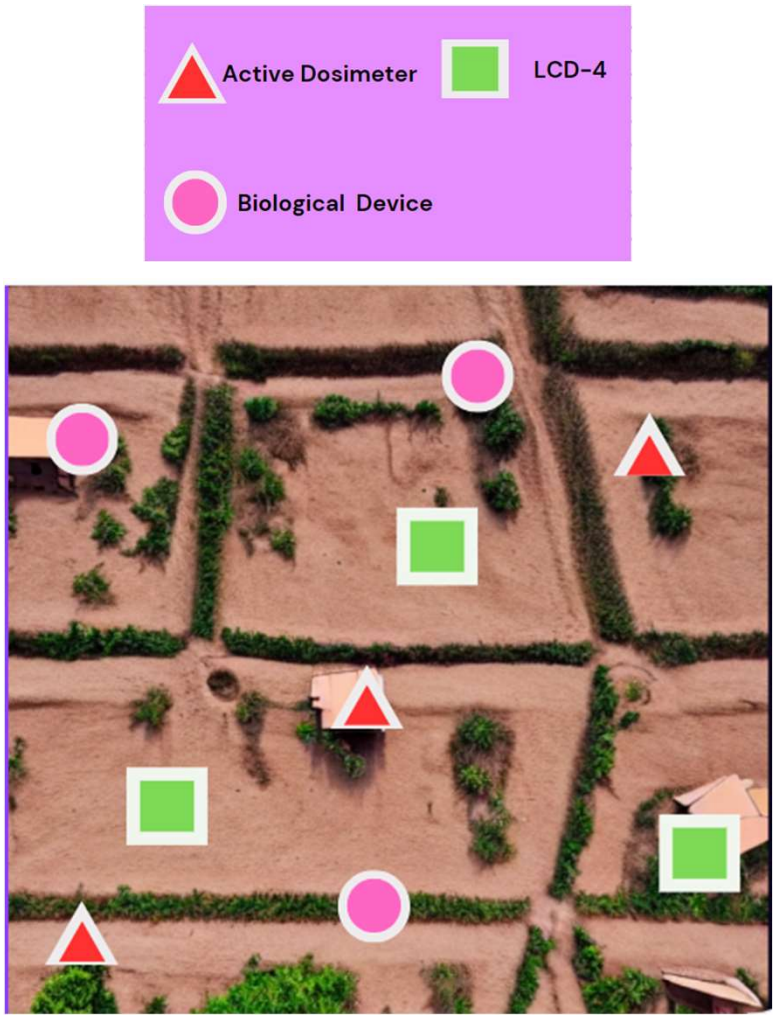


Expedition Operations

Embassy personnel are recommended to wear at least one wearable technology to detect radioactive/ chemical threats and track vitals beyond embassy grounds.

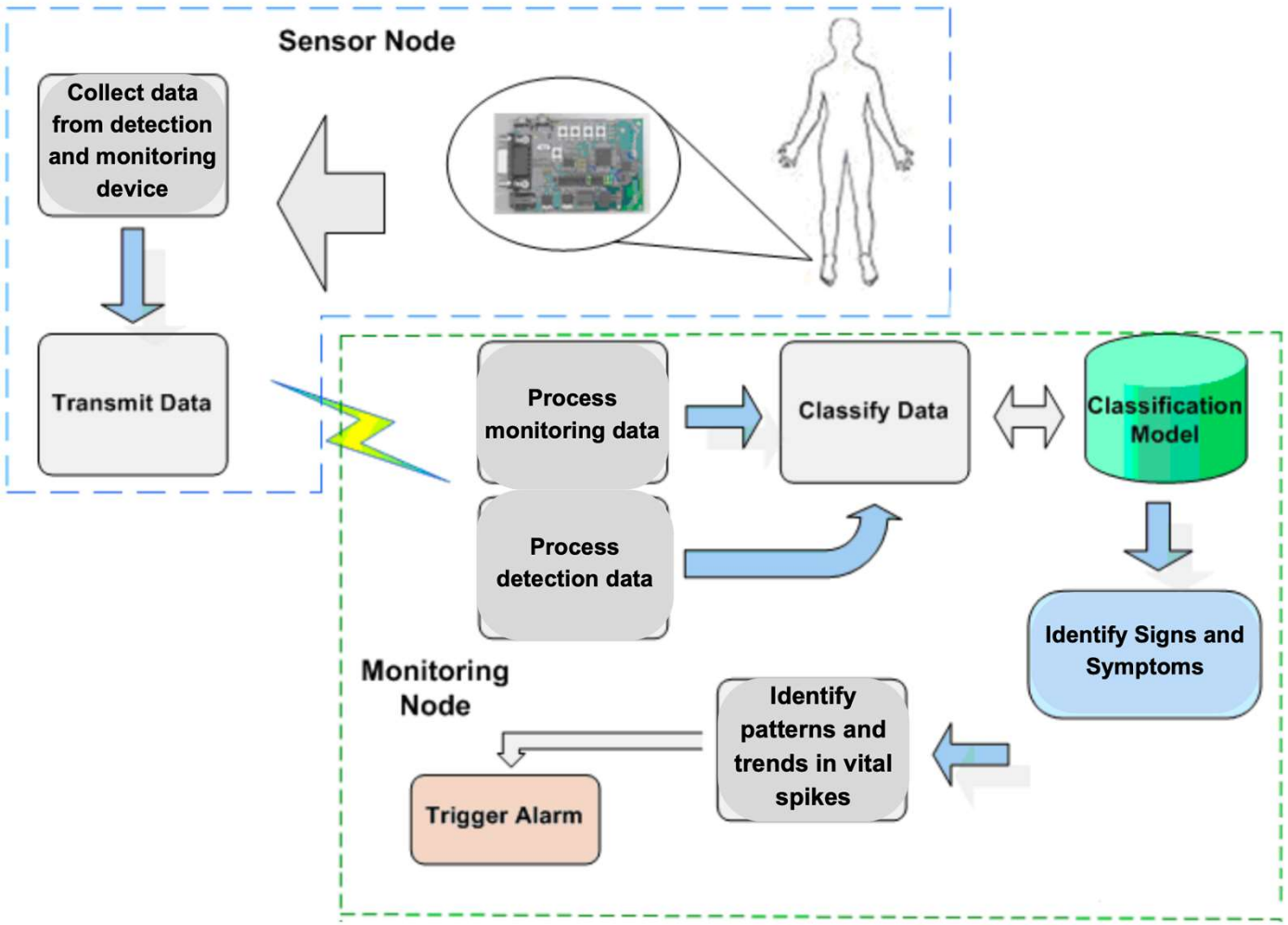
Devices include:

Active dosimeters

Smiths Detection LCD 4\

Biological monitoring device

Data Analysis and Exportability



Thank You

Any Questions?

Special thank you to our Mentor **Angela Estes** and Problem Sponsor **David Pfister**