[TITLE PAGE]

# TABLE OF CONTENTS

# CONTRIBUTORS

- Michael Antwi-Boasiako
    - PLTW Capstone - Engineering Design and Development
    - AP Calculus BC
    - AP Physics C: Mechanics
    - AP Computer Science A
    - PLTW Computer Science Essentials
    - PLTW Computer Science Principles
    - AP Physics - Algebra based
- Cameron Jiang
    - PLTW Capstone - Engineering Design and Development
    - AP Computer Science Applications
    - PLTW Computer Science Principles
    - PLTW Computer Science Essentials
    - Cisco IT Essentials
    - PLTW Cybersecurity
    - AP Calculus BC
    - AP Physics C: Mechanics
    - AP Physics - Algebra Based
    - AP Statistics
- Adam Wise
    - AP Computer Science A
    - PLTW Computer Science Principles
    - PLTW Computer Science Essentials
    - Cisco IT Essentials
    - PLTW Capstone - Engineering Design and Development

# PROBLEM DEVELOPMENT PLAN

## Prior Solutions Attempts:

- **US Patent Office:**
    - Research across US Patent Office for previous patent attempts related to our problem

- **Google Patents:**
    - Research across Google Patents for previous patent attempts related to our problem

# Market Research / Survey:

- **Observe bodycam footage/other surveillance of crises**
- **Who is your target market?**
    - Local police/fire departments and school districts are equally are target markets
    - Spending on school security has been increasing in recent years, signaling prioritization and availability of funds to address security concerns

- **What does an effective survey look like?**
    - Google form sent to experts
        - Police departments, Fire departments, and school districts
            - Saint Peters Police department
                - Local, easily accessible
            - St. Louis Police department
                - Actually sees "school danger situations"
            - Fire departments of each city
        - Open to all staff at police and fire departments, administration and security officers only at school districts
    - Google Form link:
        - First Responder Questionnaire - Google Forms
    - Potential Prompts:
        - Describe the information you usually have whenever you enter into crises.
        - Do you think that the in field information you have is adequate, or do you find yourself needing to guess?
        - Rate the overall effectiveness of the operation to handle crises with the information given on a scale from 1 to 10
        - Rate the quality of the information given before deployment and during deployment on a scale from 1 to 10
        - Do you have auditory assistance from your station's command center about situations you're in (not just communication between other responders on site, but between you and the command center)
            - Explain the extent of the information that your command center provides to you

# Expert Testimonial:

- **Who is an expert?**
  - Any first responder who has been in the midst of a chaotic and hazardous situation.
  - Building authorities who have witnessed/been victim to a building-wide threat.
  - Witnesses/victims of crises

- **Contact Process:**
  - Ask Chrissy Riley for first responder contact information. (Through CAPS)
  - Search online for people who are willing to share their testimonies of crises (Through social media)

# Academic Research:

- **Academia, government professional journal:**
  - Research through Academia and government professional journals to find previous research in regards to the problem

# Design Requirements:

- **Requirement #1: Information accessibility**
  - The solution must identify and provide real-time information about the following:
    - Building floor plan
    - Location of persons in distress
    - Location of dangerous/armed individuals
    - Location of dangerous/unstable zones
- **Requirement #2: Real-time nature.**
  - At the same time, the solution must meet the definition of 'real time'. This is defined as data that is sent and received successfully by the user as it is generated.
  - The data source may be from one or the following:
    - First responder department dispatch
    - First responder department headquarters
    - AI detection cameras

- **Requirement #3: First responder ease-of-use**
  - The solution must not inhibit first responders' ability to react effectively amidst crises by including the following:
    - Easy toggle on and toggle off
    - Customizable display
    - Lightweight AR mask

# PROBLEM STATEMENT

"Access to timely, accurate information is a cornerstone of effective decision-making in the modern era. Sourcing and distributing that data, however, is the great challenge of our time. During times of crisis, this challenge becomes even more problematic - times of crisis that have increased in prominence, with mass shootings more than doubling from 271 in 2014 to 660 in 2023. Combined with the number of total people killed via gun violence increasing from 12,411 in 2014 to 20,568 in 2022 as recognized by the Gun Violence Archive[1], these concerning statistics showcase the increasing need for greater threat management.  First responders are forced to juggle the difficulties of searching for victims, identifying threats, and navigating hostile environments all while relying on  fragmented or inaccurate data.  Prior attempts to distribute real-time data to first responders in hazardous situations include Volt AI, which is limited by its incapability to determine where the user is and incompatibility with any device other than a handheld or stationary device. These limitations inhibit Volt from being a feasible solution for first responders due to their inconvenience in crises. Lacking formal solutions, first responders must rely exclusively on their sensory perception to detect and mitigate threats. Because of this, our project aims to create a solution which allows first responders to access real-time data through augmented reality. This solution would allow first responders to utilize a 3D building layout, directions to threats and victims, and situational auditory aid."

# ELEVATOR PITCH

"First responders have difficulty getting the needed data to locate [people] in distress, imminent threats, and navigate unsafe situations. There are no current systems in place which allow said first responders to quickly disarm hazards. This results in many unnecessary casualties because first responders are forced to make judgements using incomplete and inaccurate information in unfamiliar environments to bring safety."

First responders have difficulty getting critical situational information - the location of individuals in distress, imminent threats, and unsafe areas - during

deployment. This incomplete situational information causes first responders to rely on fragmented data in critical situations. There are no current solutions to fulfill first responders' needs for accurate and real-time information on dangerous situations.

# STAKEHOLDERS

- **Primary Stakeholders**
  - First Responders
    - …
  - Victims/Civilians in Crisis Zones
    - …
  - Crisis Management Teams and Dispatchers
    - …
- **Secondary Stakeholders**
  - Government Agencies
    - …
  - Building Security Personnel
    - …

# MARKET RESEARCH

- **Expert Testimonial**
  - **Experts:**
    - Local first responders
      - Officer Gardner (School Resource Officer)
      - Saint Charles Lieutenant Pat Sykes
    - First-hand crises victims

  - **Expert Questions:**
    - What type of first responder responsibilities do you primarily associate yourself with? (Select all that apply) (MC)
    - What city are you based in? (SR)
    - Describe the information you usually have whenever you enter into life-threatening situations. (e.g. "We're given some generic information about the building layout like floor plans", "We aren't given extra information beyond what we already know of the area") (SR)

- - - Do you feel there are significant gaps in the information you receive before responding to these incidents? If so, what are they? (SR)
    - What kind of information do you wish you had going into these emergencies? (i.e. directions towards a threat, building layout, real-time situational audio updates) (SR)
  - **Email text:**
    - To whom this may concern,

      My name is Michael Antwi, and I am a student from Fort Zumwalt East High School on an engineering team designing a tool to assist first responders in dangerous situations. Me and my engineering team are reaching out to first responders in our community so we may understand the information emergency response personnel have access to in such situations.

      Please share the following form with your department: https://tinyurl.com/fzeresponder

      Thank you for your cooperation, service, and giving us the opportunity to help you all serve our community better.

  - **Expert Contact Log:**
    - Officer Gardner (School Resource Officer)
    - mbskcs@gmail.com
    - Lt. Pat Sykes - St Charles County PD/FBINA 295, Sgt. US Marine Corp, Detective/SWAT Team Leader

- **Prior Solutions Attempts/Current Patents**
  - **Prior Attempts:**
    - Lumana AI: An AI video detection solution that implements pre-trained models to "identify threats and security concerns":
      - Pre-trained AI model
      - We need it to identify and transmit slightly different information. We also need low level control of the camera's systems for real-time streaming
    - Volt AI
      - **INTERVIEW QUESTION LIST:**
        - **Question 1:** "Can you tell us what your initial target market was, and your biggest current consumer?"

- ○ **Question 2:** "Where do you envision this product going in the future?"
      - ○ **Question 3:** "On your website, you claim your product works with our existing cameras. Can you explain how you upgrade existing cameras to add AI detection functionality?"
      - ○ **Question 4:** "What data privacy and security protocols are in place to ensure that information being sent from server to client is not interfered with."
      - ○ **Question 5:** "Can you describe to us your ML model training process?"

  - ○ **Patents:**
      - US12033480B2[1] - Image-based real-time intrusion detection and prediction method and surveillance camera using artificial intelligence
      - US5969755A[2] - Motion based event detection system and method
      - US20200364468A1[4] - Intelligent video surveillance system and method which organizes people and objects into distinct labels
      - US6028626A[5] - Abnormality detection and surveillance system

- ● **Previous Research**
  - ○ 3D Building Interior Models[6]
  - ○ Augmented reality points of interest for improved first responder situational awareness[7]

# INTERPRETATION OF DATA/RESEARCH

# POSSIBLE SOLUTIONS

# PROTOTYPE(S)

# BIBLIOGRAPHY