**Please make a copy of this document (do not ask for edit permissions)**Replace the highlighted and/or instruction part of this proposal with your team’s answers.   
Please see the limits of each answer below. There will be no limit on page numbers, but please be consistent with the limitation for each question.

A **Problem Statement** is a concise description of an issue to be addressed or a condition to be improved upon. It identified the gap between the current (problem) state and desired (goal) form of a process or product. Focusing on the facts, the problem statement should be designed to address the Five Ws. The first condition of solving a problem is understanding the problem, which can be done using a problem statement. [Wikipedia]

A **Research question** is a question that a research project sets out to answer. Choosing a research question is an essential element of both quantitative and qualitative research. An investigation will require data collection and analysis, and the methodology for this will vary widely. Good research questions seek to improve knowledge on an important topic and are usually narrow and specific. [Wikipedia]

**Team ID : CH2-PS353**

**Team Member :** (Pelase adjust according to your team members)

1. (ML) M172BSX0222 – Nabila Zahra Lubis – Universitas Mikroskil - [Active]
2. (ML) M323BSX0400 – Balgis Amalia – Universitas Tadulako - [Active]
3. (ML) M542BSY1798 – Mahendra Khamal Akbar – STMIK PPKIA Pradnya Paramita - [Active]
4. (CC) C175BSY3558 – Dimas Aditya Purwadi Putra – STMIK Sinar Nusantara - [Active]
5. (CC) C433BSX4242 – Nadia Nandatama Syahrani – Universitas Internasional Semen Indonesia - [Active]
6. (MD) A175BSY2445 – Muhammad Gibran Al Fajr – STMIK Sinar Nusantara - [Active]
7. (MD) A425BSY2652 – Benedict Giovanni Atmaja – Universitas Bandar Lampung - [Active]

**Final Selected Themes:**

Post-Pandemic & Emergency Responses

**Title of the Project:**

SmartBlaze : A Comprehensive fire detection system with integrated AI

**Excecutive Summary/Abstract:**

A short (~1000 chars/200 words) abstract, **describing your project**. Includes your **Problem Statement, Research Questions, background information**, and **why** your team wants to tackle the problem.

[Try to build a painkiller instead of a vitamin](https://www.entrepreneur.com/article/230736). If you’re unsure, you may use techniques such as [design thinking](https://www.thinkwithgoogle.com/intl/en-apac/future-of-marketing/creativity/design-thinking-principles/" \l ":~:text=At Google%2C design thinking helps,methodologies for interviewing potential employees.) or its [alternatives](https://delightfuldesignstudio.com/alternatives-to-design-thinking/).

Currently, fire incidents can pose a serious threat to safety and property. Early fire detection is of utmost importance in mitigating risks and minimizing potential losses. However, many existing fire detection systems tend to be disjointed, less sophisticated, and lack the ability to provide timely and accurate warnings.

This project aims to address crucial questions, such as how to integrate advanced sensors into indoor spaces to monitor relevant environmental parameters. We aim to understand how to efficiently and securely transmit data from these sensors to the cloud. Additionally, we are interested in exploring the implementation of artificial intelligence (AI) and machine learning techniques to predict potential fires based on time series data. Furthermore, we seek to find ways to design an intuitive and effective mobile application for visualizing sensor data, providing fire hazard alerts, and enabling remote monitoring.

The idea stems from the realization that advances in sensor technology, cloud computing, and artificial intelligence can help proactively and efficiently tackle indoor fire detection challenges. We believe that by leveraging AI to analyze real-time sensor data, we can predict potential fires earlier and design a mobile application that allows for better monitoring and rapid warnings.

**How did your team come up with this project?**

[your answer, (Paragraph, up to 100 words)]

Our team's commitment to addressing these security challenges is the genesis of this project. Our inspiration for this project stems from a profound awareness of the critical need for improved indoor fire detection and security. We recognize that current fire detection systems often lack sophistication and real-time responsiveness. This impelled us to explore a holistic and proactive approach to fire management by integrating the potential of sensor technology, cloud computing, and artificial intelligence to create a comprehensive solution for indoor fire detection. We apply design thinking principles to comprehend user needs and their challenges in the context of fire safety.

**Project Scope & Deliverables:**

The outline of the project’s boundaries and description of how your team will break down the task and responsibilities into measurable deliverables. Detailed scope (daily) is preferable. But weekly is also acceptable. **Please be advised that you have approx. a month to complete this project. You can use a table or list of tasks and responsibilities or deliverables.**

| **Day** | **Tasks and Responsibilities** | **Team Members** | **Expected Result** |
| --- | --- | --- | --- |
| 1 | Define project objectives, success criteria, and team assignment. | All Team | Each member understand their assignment and jobdesk |
| 2 | Conduct initial research on sensors and research on APIs. | Cloud Computing Team | Compiled research report with sensor and APIs. |
| 3 | Design Prototype for Mobile Application (Figma) | MD Team | All members agreed to the design (UI & UX) |
| 3-4 | Prepare the development environment and hardware setup. | ML Team | Functional development environment and hardware setup. |
| 5-6 | Project planning and work plan development. | Project Manager | Comprehensive work plan document. |
| 7-9 | Procure sensors and assemble sensor devices. | ML Team | Assembled sensor devices ready for testing. |
| 10 | Test basic sensor functionality and data acquisition. | ML Team | Documented test results and functional sensors. |
| 11-12 | Select cloud platform and implement data transmission. | Cloud Computing Team | Configured cloud platform with successfully implemented data transmission. |
| 13 | Test data transmission to the cloud. | Cloud Computing Team | Documented test results and successful data transmission. |
| 14-16 | Collect historical data for AI model training. | Machine Learning Team | Dataset ready for AI model training. |
| 17-18 | Develop and train AI model for fire hazard prediction. | Machine Learning Team | Trained AI model capable of fire hazard prediction. |
| 19-20 | Implement real-time data processing and AI. | All Team | System prototype with real-time data processing and AI integration. |
| 21-23 | Develop Mobile Application | MD Team | Functional mobile application. |
| 24-25 | Integrate mobile application with API and AI. | MD Team | Integrated mobile app with cloud and AI functionalities. |
| 26 | Implement real-time data visualization. | MD Team | Mobile app displaying real-time sensor data. |
| 27-28 | Test and address system errors and issues. | ML Team, MD Team | Documented test results and resolved issues. |
| 29 | Prepare project report and presentation for stakeholders. | All Team | Completed project report and presentation materials. |
| 30 | Evaluate and train data sensors classification model. | Machine Learning Team | Trained data sensors classification model. |

**Project Schedule:**

A high-level view of project tasks and milestones (Gantt charts or timeline should be handy for this). Make sure that the milestones are already agreed upon between your teammates. Try to keep everyone in check at all times :) Making a timeline is easy. **Making a sensible timeline that your teammates can comply with, is easier said than done.** :)

**To do**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Task** | **Week 1** | **Week 2** | **Week 3** | **Week 4** |
| **Project Initiation** |  |  |  |  |
| **Sensor Integration** |  |  |  |  |
| **Cloud Integration** |  |  |  |  |
| **Machine Learning Model** |  |  |  |  |
| **Mobile App Development** |  |  |  |  |
| **Testing and QA** |  |  |  |  |
| **Deployment & Training** |  |  |  |  |
| **Documentation & Report** |  |  |  |  |
| **Presentation & Review** |  |  |  |  |

**Based on your team’s knowledge, what tools/IDE/Library and resources that your team will use to solve the problem?**

[your answer, (List of tools, IDE, Library, platform, API, resources]

|  |  |  |
| --- | --- | --- |
| **Category** | **APITools/IDEs/Libraries/Platforms/APIs** | **Description** |
| **Programming** | Arduino IDE | Integrated Development Environment for Arduino board programming. |
| **Cloud Computing** | AWS, Azure, Google Cloud | Cloud platforms for data storage, processing, and real-time management. |
| **Machine Learning** | TensorFlow, PyTorch | Machine learning frameworks for AI model development. |
| **Mobile App Development** | Android Studio | IDE for creating the mobile application for real-time monitoring. |
| **Version Control** | GitHub | Platform for version control and team collaboration. |
| **Sensor Libraries** | Arduino Sensor Libraries | Libraries to facilitate data acquisition from various sensors. |
| **Cloud APIs** | Cloud Platform APIs | APIs for data transmission, storage, and retrieval from the cloud. |
| **Machine Learning Libraries** | scikit-learn, Keras | Python libraries for machine learning and AI model development. |
| **Android Development Libraries** | Android SDK | Libraries and SDK for Android app development. |
| **Hardware** | Sensor Hardware | Procurement of high-quality sensors for data acquisition. |
| **Historical Data** | Historical Data Collection | Data collection for training the AI model to predict fire hazards. |
| **Documentation and Tutorials** | Online Resources | Utilizing online documentation, tutorials, and open-source resources for guidance. |
| **Team Collaboration** | Communication Tools | Effective communication tools and regular team meetings for collaboration. |
| **Cloud Services** | Cloud Subscriptions/Access | Access to cloud services for data storage, real-time analysis, and scalability. |

**Based on your knowledge and explorations, what will your team need support for?**

[your answer, (List of items, mentors, data, supporting resources)]

|  |  |
| --- | --- |
| **Area of Support/Resources** | **Description** |
| **Mentors or Subject Matter Experts (SMEs)** | Guidance and mentorship from experts in fire safety, sensor technologies, cloud computing, and machine learning. |
| **Historical Data** | Access to historical data related to indoor fire incidents for training the AI model. |
| **Funding** | Financial support or grants to procure sensors, cloud services, and hardware components. |
| **Testing Facilities** | Access to controlled testing facilities for experiments and system performance testing. |
| **Open-Source Libraries and Resources** | Utilizing open-source libraries, datasets, and online resources for development. |
| **Training** | Specialized training or workshops on sensor calibration, machine learning, and cloud computing for team members. |

**Based on your knowledge and explorations, tell us the Machine Learning Part of your Capstone!**

[your answer, Paragraph, up to 50 words.

* AutoML or similar automated model creation and pre-built models are prohibited.
* Team has to train their own model, or use transfer learning.
* You may use the AI platform, tensorflow.js, TFLite, and other alternatives to deploy your model. Please avoid Google colab or local notebooks/files for the production/demo.
* Using Tensorflow is mandatory. You may use other libraries on top of Tensorflow.

The machine learning team will design, train, and implement a TensorFlow-based machine learning model to detect indoor fire hazards. Transfer learning may be employed, utilizing existing neural network models trained on diverse image. Our process involves data collection and preprocessing, model development, training, validation, and implementation.

**Based on your knowledge and explorations, tell us the Mobile Development Part of your capstone?**

[your answer, Paragraph, up to 50 words.

* Webview, Appinventor, and any other automated wizard/app-creation are prohibited.
* Team has to use native Kotlin/Java/C++ and Android Studio to create the Android app.
* Using flutter, react, or other multiplatform-based is allowed for creation of app in other platform (e.g. Windows/iOS/Linux) on top of the native Android.
* You may attach Figma or other links related to this plan.

To access real-time data from the server, our Android app will use RESTful APIs and WebSocket communication. We'll employ Android's native development tools, such as Retrofit for API integration and LiveData for real-time data updates. The app will feature interactive UI components for user engagement.

**Based on your knowledge and explorations, tell us the Cloud/Web/Frontend/Backend Part of your capstone?**

[your answer, Paragraph, up to 50 words.

* There is no limitation on programming languages, libraries, or frameworks.
* Team has to create at least **1 private API or endpoint** including authentication, authorization, and API/endpoint documentation.
* Team may use any **APIs or third party services available**, but you need to write documentation on how & why you use that specific API.
* On unstable API or services, please plan to have alternative endpoints and/or create your own data generator to make sure your project works on demo/judging day.
* You may attach Figma or other links related to this plan.

Sensor data will be collected through Arduino devices, then transmitted to the cloud server via the appropriate communication protocol. In the cloud server, the data will be processed, stored, and analyzed using a private API with authentication and authorization layers, ensuring the security and availability of sensor data for real-time monitoring.

**Based on your team’s planning, is there any identifiable potential Risk or Issue related to your project?**A list of factors that could derail the project and a plan for how issues will be identified, addressed, and controlled. Probably also good if you already have plan(s) for rectifying the identified factors or threats. up to 100 words)

Our project faces several potential risks and challenges, including the need for precise sensor calibration to avoid false alarms, potential connectivity issues, data security concerns, and the requirement for a diverse and extensive dataset to develop an accurate fire prediction model. Ensuring uninterrupted power supply to all components is also critical for continuous operation. Integrating sensors, the mobile app, and the cloud server seamlessly may pose technical challenges. Nonetheless, our multidisciplinary team is prepared to address these risks systematically, focusing on sensor technology, data security, and efficient power management to ensure the success of our fire safety solution.

**Any other notes/remarks we should consider on your team’s application**

[your answer, (Optional, Paragraph, up to 100 words)]

To accommodate the scenario where the application may not be fully completed by the time of our presentation, we are preparing a detailed and interactive prototype using Figma. This prototype will serve as a dynamic and illustrative tool to demonstrate our design philosophy and the sophisticated functionalities we are integrating. It will provide stakeholders with an opportunity to experience the user journey firsthand and offer valuable feedback that we can incorporate into the final stages of development, ensuring that our solution not only meets but exceeds the expectations for modern fire safety technology.