



## Senior Design Project – CSE499

# A Machine Learning and Embedded Approach to Detect Fire, Identify the Cause of it and Extinguish Using the Best Possible Extinguisher

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**Faculty Advisor:**

**Md. Shahriar Hussain**

**Senior Lecturer**

**ECE Department**

**Fall, 2022**

# LETTER OF TRANSMITAL

February, 2023

To

Dr. Rajesh Palit

Chairman,

Department of Electrical and Computer Engineering

North South University, Dhaka

Subject: Submission of Capstone Project Report on “**A Machine Learning and Embedded Approach to Detect Fire, Identify the Cause of it and Extinguish Using the Best Possible Extinguisher**”

Dear Sir,

With due respect, we would like to submit our Capstone Project Report on “**A Machine Learning and Embedded Approach to Detect Fire, Identify the Cause of it and Extinguish Using the Best Possible Extinguisher**” as a part of our BSc program. This project was very much valuable to us as it helped us gain experience from practical field and apply in real life. We tried to the maximum competence to meet all the dimensions required from this report.

We will be highly obliged if you kindly receive this report and provide your valuable judgment. It would be our immense pleasure if you find this report useful and informative to have an apparent perspective on the issue.

Sincerely Yours,

Md Rashiqur Rahman

ECE Department

North South University, Bangladesh

Sabbir Ahmed

ECE Department

North South University, Bangladesh

MD Shafin Islam Rudro

ECE Department

North South University, Bangladesh

Sadia Aktar

ECE Department

North South University, Bangladesh

# APPROVAL

Md. Rashiqur Rahman (ID #1812366042), Sabbir Ahmed (ID #1813515042), Md. Shafin Islam Rudro (ID #1821054642), and Sadia Aktar (ID #1821516042) from Electrical and Computer Engineering Department of North South University, have worked on the Senior Design Project titled “**A Machine Learning and Embedded Approach to Detect Fire, Identify the Cause of it and Extinguish Using the Best Possible Extinguisher**” under the supervision of Md. Shahriar Hussain partial fulfillment of the requirement for the degree of Bachelors of Science in Engineering and has been accepted as satisfactory.

## Supervisor’s Signature

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**Md. Shahriar Hussain**

**Senior Lecturer**

Department of Electrical and Computer Engineering

North South University

Dhaka, Bangladesh.

## Chairman’s Signature

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**Dr. Rajesh Palit**

**Professor**

Department of Electrical and Computer Engineering

North South University

Dhaka, Bangladesh.

# DECLARATION

This is to certify that this Project is our original work. No part of this work has been submitted elsewhere partially or fully for the award of any other degree or diploma. Any material reproduced in this project has been properly acknowledged.

Students' names & Signatures

**1. Md. Rashiquur Rahman**

*Rashiquur Rahman*

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**2. Sabbir Ahmed**

*Sabbir Ahmed*

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**3. Md. Shafin Islam Rudro**

*Md. Shafin Islam Rudro*

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**4. Sadia Aktar**

*Sadia Aktar*

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## **ACKNOWLEDGEMENTS**

We would like to extend our sincere gratitude to the Almighty for bestowing us with the strength and determination to complete this project successfully. Our capstone project as part of the BSc curriculum has provided us with a valuable opportunity to apply the theoretical knowledge we have gained and gain real-world experience. We are deeply thankful to our teachers who guided us and provided us with the technical skills and support needed to successfully complete this project. Our special thanks go to Md. Shahriar Hussain, an esteemed member of the department, for his unwavering support and invaluable assistance throughout the project. We are also grateful to the ECE department at North South University for offering us the CSE 499 course which allowed us to delve deep into this project and bring it to fruition. Lastly, we would like to express our appreciation to our friends and family for their constant encouragement and support. Their contributions have been instrumental in making this project a reality.

## **ABSTRACT**

# **A Machine Learning and Embedded Approach to Detect Fire, Identify the Cause of it and Extinguish Using the Best Possible Extinguisher**

Chemical fires are a major cause of devastating situations and fatalities in Bangladesh, where inadequate knowledge of extinguishing such fires has led to numerous deaths, including those of firefighters. To address this issue, we propose a machine learning and embedded systems approach to design a dynamic and portable prototype that can remotely monitor the fire incident and determine its cause. The prototype uses a dashboard camera to stream video and gas sensors to detect the chemical gas information in the environment to identify and extinguish the fire. The embedded approach clarifies the cause of the fire and suggests the most suitable extinguisher to the user. The device is economical, portable, user-friendly, and marketable in Bangladesh. The system produces satisfactory results with high accuracy in fire detection and maintains its objective of being low-cost and user-friendly. The device can be remotely controlled using a mobile phone and web-based application. The system's machine learning approach uses appropriate datasets and algorithms (YOLOV5), while the embedded approach employs suitable sensors and a microcontroller (ESP32). The system's accuracy has been shown to be perfect.