CHAPTER I

1. Introduction

1.1. Background

Based on fire data on the DKI Jakarta Sectoral Statistics Portal in 2020, out of 1,505 fire cases, the highest cases were house fires [1]. When a fire occurs, people usually only realize when the fire has started to grow. Sometimes fires even occur when people are not at home [2]. The problem with conventional fire detection systems that use fire and smoke sensors is distance detection. For example, in research [3], in this study using an Ardunio microcon-troller-based system and fire and smoke sensors, it was stated that the maximum distance between two pieces of paper being burned is 140 cm. This means if the fire point is at a greater distance then the system cannot detect a fire, of course this will be problematic if used in a wider room. Based on these problems, an automation system is needed that can detect fires early in a large room. A method that can be used is fire detection with image classifica-tion. There is a model for image classification developed by Google called MobileNetV2. This model has a well-known Convolutional Neural Network architecture which is quite light [4]. Although quite light, this model has comparable accuracy to heavier models.

In research [4], the MobileNetV2 model can detect objects up to a distance of 5 meters, with an average accura-cy value of 100%, even at a distance of 25 meters an average accuracy of 89.5% is still obtained. In research [5], the comparison results in mask detection showed that MobileNetV2 had a classification accuracy of 98% and 99% respectively in datasets 1 and 2, while DCNN had a classification accuracy of 97% in both datasets. In research [6], from a small data set, the MobileNetV2 model has a classification accuracy of 96%. In research [7], the Mo-bileNetV2 model obtained up to 85% accuracy outperforming ResNet50V2, InceptionV3, and InceptionResNetV2 in terms of accuracy and efficiency. In research [8], testing on 168 of 192 sets of normal, early, and late stage SSC images were correctly diagnosed by the MobileNetV2 model. The accuracy obtained as a whole reaches 87.5%. These findings indicate that when classifying normal, early, and late SSC skin images, the MobileNetV2 architec-ture is more precise and effective than CNN. In research [9], the MobileNetV2 model was used

for fruit classifica-tion, on three different datasets, respectively, this model was able to achieve a stable classification accuracy of 95.75, 96.7 and 96.23%. This is higher than other methods such as Light-CNN, Fruit-CNN, and CNN-Augmentation. In research [10], the accuracy of the classification of MobileNetV2 vehicle types is higher than Alexnet. Alexnet's accuracy is 93.81 and 96.19%, better than the accuracy of the VGGNet mini in the previous study, which was 73%. In research [11], the performance of this deep learning-based pedestrian detection system obtained a maximum confidence level of 90% in daytime imagery conditions, 60.40% of the images can be detect-ed perfectly. For evening imagery conditions, a maximum confidence level of 85% can detect 62.25% of the image perfectly. In research [12], the MobileNetV2 architecture can predict the position of objects both day and night, with up to 52% precision for objects at close or far distances. In research [13], the accuracy of human detection with MobileNetV2 from three different datasets is 98.0%, 82.0%, and 97.00%. The detection results are more accurate than MobileNetV1 pre-trained, which achieved 80.25% accuracy when tested with Pascal VOC2012.

In this research, the system will use the MobileNetV2 model to detect fires in real-time. It is hoped that the use of this model can increase the distance and response time of the fire detection system. The model is built using Edge Impulse based on the TensorFlow and Keras libraries. The system will use a laptop with an Nvidia GeForce MX130 GPU, a smartphone camera with 48MP resolution, and the OpenCV library for the image classification process, as well as Telegram for sending fire notifications via the Requests library. This research will focus on analyzing the accuracy, distance, and response time of the system in detecting fire images using the MobileNetV2 model and comparing it with the Arduino microcontroller-based fire detection system in research [3].

1.2. Problem Formulation

In research there were several problems found, here are some problems found:

1. How to implement a real-time fire detection system with image classification using the MobileNetV2 model?
2. How does the accuracy, distance, and response time of the system in

detecting fire images using the MobileNetV2 model compare to conventional fire detection systems in the study [3] ?

1.3. Purpose

In this study there are several objectives, which are as follows:

1. To implement a real-time fire detection system with image classification using the MobileNetV2 model
2. To analyze the accuracy, distance, and response time of the system in detecting fire images using the MobileNetV2 model and comparing it with conventional fire detection systems in research [3].

1.4. Issue Limitations

In this study there are several limitations, which are as follows:

1. In this study, the scope of system detection was house fires, especially in the room of the house. In addition to the fact that the data on house fires is the highest, it is also because it is very likely that the detection system cannot reach a large area, such as fires in the forest.
2. Testing is carried out until the system cannot detect any fire.