

## I. INTRODUCTION

Indonesia has recently had a reasonably high growth rate of vehicles. This growth in the number of vehicles must be accompanied by good road load management so that road maintenance costs are not high. Road traffic monitoring aims to collect the necessary data for optimizing traffic control and management, predicting future transportation needs and establishing development plans [1]. In this study, we used an initial measurement unit (IMU) sensor device to measure speed, orientation, and gravitational force using an accelerometer and gyroscope [2]. The IMU here is a sensor that reads road conditions and then processes them to classify vehicles crossing the road. Overloaded vehicles are one of the main problems in Indonesia, many overloaded vehicles cross the freeway and cause road conditions to deteriorate so that they can harm others. Using this tool, the government or toll road developers can prevent vehicles with excess loads from passing through certain roads so that road maintenance is minimal and other vehicles are safer.

An information-based classification system is a technique for borrowing (classifying) data into one or several predetermined classes [3]. Vehicle classification plays a vital role in road maintenance, traffic flow modelling, and road safety management [4]. The K-Nearest Neighbor classification algorithm is a classification method that assigns categories based on the majority of categories in the k-Nearest Neighbor, done by finding k groups of objects in the training data that are closest (similar) to the objects in the new data or test data [5]. The Nearest Neighbor Retrieval (K-Nearest Neighbor or K-NN) algorithm is an algorithm for classifying objects by learning the data closest to the object [6]. The KNN algorithm aims to classify new objects based on attribute and training samples. The new test sample results are classified based on most of the categories in the KNN [7]. The classification of vehicles carried out in this study uses the KNN algorithm and is compared with the Random Forest (RF) algorithm. Random Forest is defined as the general principle of a random ensemble of a decision tree [8]. Algorithmic Random Forest Classifier is the development of a decision tree, where each decision tree will conduct data training using an individual sample. Each attribute is broken down into a tree to be selected between a random subset of attributes [9]. The general idea of the bagging method is that it is a learning combination model that improves the overall result. After being classified, the level of measurement is measured using machine learning. Machine Learning is a method that many researchers often apply. machine learning was introduced to help improve auto-detection capabilities. Method Machine learning automates work as efficiently and effectively as classification models adopt a mixture of mathematical and search methods from computer science [10]. Machine Learning is one of the modern scientific methodologies that can carry out automatic procedures to produce predictions on a phenomenon by making observations of previous events, namely looking for patterns in each data set [11]. Machine learning algorithms build mathematical models from sample data, known as "data training or data training", to make predictions or decisions without being explicitly programmed to perform a task. The core workflow of machine learning is about taking raw data as input and generating predictions as output [12]. Vehicle classification can also be used to accommodate vehicle classes when paying tolls. In some cases, truck drivers often commit fraud, namely paying tolls at lower-class rates. With this tool, toll road developers can determine the class of vehicles more accurately to avoid cheating.

This research focuses on identifying problems such as what kind of vibration can be classified as a vehicle and where the sensor will be placed. Specifications Requirements in this study are vibrations on the streets that can be read with an accelerometer and gyroscope.

This research aims to develop tools and applications to detect and classify vehicles that pass through a road section in a certain period. The methods include IMU signal processing, wave propagation models, feature extraction, and vehicle classification.