

# Weigh-in-motion Using Machine Learning and Telematics

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**Abstract**— Driving overloaded vehicle causes road infrastructural damages, accidents, air pollution by excessive fuel consumption, and unusual expenses. Measuring the gross weight of a vehicle on a particular road segment without interrupting the traffic flow is a problem worth researching, and its solutions have several economic benefits. This paper proposes an alternative way of finding an overloaded vehicle in motion, by introducing a novel approach in inferring the weight of a vehicle on a road segment using Telematics data and Machine Learning.

**Keywords**—Telematics, WIM, Machine Learning, ECU.

## I. INTRODUCTION

Driving and road safety are current and growing problems with global dimensions [1]. According to the global status report on road safety conducted by the World Health Organisation (WHO), 1.24 million traffic-related fatalities occur annually worldwide [2]. Notably, in 2011 South Africa had the highest number of fatalities according to the International Road Traffic and Accident Database (IRTAD) annual road safety report 2013 [1]. Due to the amplified necessity for mobility in developed and developing countries, the growth in vehicle manufacturing is inevitable. Driver assistance and safety awareness programmes have been some areas of focus to minimise road safety incidents, and since the WHO launched their “Decade of Action for Road Safety (2011–2020)” programme, a remarkable improvement in road safety has been noticeable. According to U.S. Department of Transportation, it was observed that two factors, vehicle condition and road/environment conditions, were collectively responsible for 5.2% of the road accidents [3].

The contribution of human behaviour towards traffic accidents is an important area of interest in the remedial attempts to address the global road safety problem [1]. Risk-taking driving behaviour plays a major role in most of the accidents. It is discussed that over speeding, sudden acceleration/breaking,

hard cornering, not wearing seatbelts are some of the risk-taking driving behaviours [4].

Driving an overloaded vehicle is an illegal and punishable offence in most of the countries as it leads to accidents and infrastructural damages. South African National Road Traffic Regulations states the overloading scenarios which lead to prosecution for an offence under regulations in National Road Traffic Act, 1996 [5].

Kerb Weight is the total weight of a vehicle with a full tank of fuel and excluding accessories, luggage, and passengers. Gross Vehicle Weight (GVW) is the maximum allowed weight of a vehicle when fully loaded. GVW is the sum of Kerb Weight and Payload. The payload is the maximum load a vehicle can carry as specified by the manufacturer. Vehicles loaded with the more than the payload or weigh more than GVM is considered as overloaded [6].

An overloaded vehicle causes various ill effects such as vehicle’s mechanical component degradation [7], air pollution by increased greenhouse gas emissions [8], increased fuel consumption [9], road infrastructural damages [10], [11]. Furthermore, an overloaded vehicle becomes less stable as the centre of mass changes. This leads to less traction control and difficult to steer. In addition to that, since it needs additional braking distance, an overloaded vehicle is more prone to road hazards[12]. Additionally, an overloaded vehicle becomes a cause of traffic congestion and causes risks when overtaking as it goes underpowered [13].

However, it is the responsibility of governments, vehicle manufacturers, researchers and the road users to reduce the number of fatalities. Several steps have been taken by the governments to address it. Notably, in South Africa, the Department of Transport with other institutions has drafted a policy to address the problem of overloaded vehicles. Their policy enforces only 5% tolerance on the mass limit and is been allowed for road traffic act in South Africa [14].