CHAPTER I
INTRODUCTION

This chapter contains an explanation of the research background, research objectives, problem formulations, scope, and writing systematics of the report.

1.1 Background

In the wake of 21st century, the ability to exchange information quickly and easily has become one of the primary needs of society, starting from the invention of telephone to the emergence of internet. It is evident that the telecommunications industry will experience significant growth overtime with increasingly competitive landscape. Global telecommunication industry is estimated to have market value of US$1.805,61 billion, it is one of the fastest-growing industries in the world (Grand View Research, 2023), this includes Indonesia with its projected market valuation to be US$14,22 billion (Mordor Intelligence, 2023).

Figure 1.1 Indonesian telecommunications market valuation outlook
(Source: Mordor Intelligence, 2023)

Significant growth of the telecommunication industry can be attributed to several factors, the increasingly progressive regulations affecting telecom companies, increased competition in the industry, and intensive investment on innovation and R&D, which stimulates innovation, growth, and productivity

(Sengupta and Fanchon, 2009). Thus, to accommodate such tremendous growth, telecommunication companies started providing various solutions such as mobile broadband (4G LTE, 5G, etc.) and fixed broadband (home/enterprise Wi-Fi) that requires building and maintaining infrastructure, where skilled technician is required (Tsai, Sandy and Bauer, 2014). However, such operations are equipped with the risk of workplace accidents.

Accidents are one of the many looming threats faced by employees in workplace. In Indonesia alone, 297.725 cases of workplace accident have been recorded in 2022. A significant increase around 27,03% from the previous year (BPJS Ketenagakerjaan, 2022). In any industry, workplace accidents caused significant loss and negative impacts for both employees and employers. In context of employers, workplace accidents lead to productivity loss, extra costs for injury compensation, reparation, medical expenses, and supervision, as for employees, workplace accidents lead to mental and physical pain with varying degrees of suffering (Hrymak et al., 2007).

Figure 1.2 Graph showing the number of occupational accidents in Indonesia year-by-year from 2015 to 2022
(Source: BPJS Ketenagakerjaan, 2022)

Workplace accidents faced by workers are unique to the industry/sector that it specializes. However, in case of telecommunications sector, workers (especially technicians) are posed with various hazards during high-risk operations, those

included works at height, works with high voltage, works at ground tank, works at manhole, and works at optical slicing (PT Telkom Indonesia (Persero) Tbk, 2022).

To provide safety and protection for employees, especially those working in high-risk area, a preventive measure should be taken, especially with the fact that there have been several cases of workplace accidents in Company X group caused by complacency in using personal protective equipment (PPE) and in workplace health and safety in general. One of those cases is the death of a technician working in base transceiver station (BTS) operated by Company X in 2015, in which the technician, aged 34, fell from the altitude of 36 meters. It is known that the accident is caused by the technician not wearing personal protective equipment before conducting tower maintenance (Purniawan, 2015). Another case is the death of 5 Company X technicians in 2021, this accident occurred during the network maintenance operation in Tangerang City, Banten. It is known that the 5 technicians are not properly equipped with personal protective equipment (PPE) for the operations, this caused Company X to receive police inquiry for this case (Tristiawati, 2021).

These facts are also supported by research conducted on Company X branch Padang which reveals 70% of field technicians are not properly equipped with personal protective equipment during operations, even though the equipment is provided by the company for them to use. In fact, more than half of field technicians claimed that there is a lack of proper supervision in Company X branch Padang (Indah, 2019). Another thing which raises concern and urgency is the fact that a system for remote monitoring and documentation of PPE enforcement among technicians does not yet exist for Company X and its subsidiaries, the implementation of HSE-MS for operations mainly consists of pre-work checklist, safety talk, and periodical evaluation (PT Telkom Indonesia (Persero) Tbk, 2022).

In response to these challenges, the researcher sensed an urgency to conduct research and develop a system for technicians to use which will simplify documentation and enforcement of safety-first approach in technical operations for

a telecommunication company in Indonesia, specifically Company X. The goal for developing such solution is to enforce the compliance of technicians to occupational health and safety through a monitoring system, and to improve the safety and well-being of their technicians by optimizing the occupational accident avoidance. This research is relevant because it will provide an improvement to safety practices for operations in the telecommunication industry by enforcing the usage of PPE efficiently, this is crucial with the expected increase of telecommunications industry (Grand View Research, 2023) and the increasing frequency of work-related accident in recent years (BPJS Ketenagakerjaan, 2022). Also, the research aligns with the 11th industrial engineering body of knowledge (BoK) through expanding the possibilities of improving a system by integrating data/information systems and promising future technologies. ther than that, this research and its solution showcase the output and researcher's understanding on several industrial engineering subdisciplines, which includes (but not limited to): *Artificial Intelligence*; *Data Analytics*; *Data Engineering & Design*; *Computer Programming*; and *Workplace Health, Safety & Environment*.

In conclusion, industries such as telecommunications are facing consequential challenges being the increasing work-related accidents that impacted the well-being of employees, which lead to bigger tangible and intangible losses for both employees and employers. Adding to the fact that the telecommunications industry market valuation increasing every year, there needs to be an efficient way to enforce the safety protocols, including the usage of personal protective equipment (PPE) for technicians. Thus, research is conducted to analyze the potential and develop a solution for such challenges.

1.2   Problem Formulation

Problems relevant to this research is formulated as such.

1.   How to develop a model/system to monitor personal protective equipment (PPE) compliance for technicians?

2. How does the monitoring model/system perform in detecting personal protective equipment (PPE) compliance for technicians?
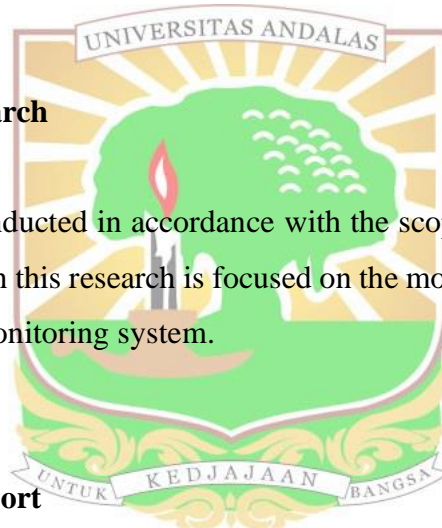
1.3 Research Objectives

Research is conducted to achieve these objectives.

1. Understanding the procedure required to develop a model to monitor personal protective equipment (PPE) compliance for technicians.
2. Developing an accurate PPE monitoring model to support companies increasing its operational efficiency and safety.

1.4 Scope of Research

Research is conducted in accordance with the scope and boundaries set by the researcher, in which this research is focused on the model development process for PPE compliance monitoring system.

1.5 Outline of Report

Report of the research is designed in accordance to the following outline.

CHAPTER I   INTRODUCTION

This chapter contains the background of research, formulations of problem, research objectives, scope of research, and outline of report.

CHAPTER II   LITERATURE REVIEW

This chapter contains the explanation of theories relevant to the topic of research, this includes the explanation of PPEs,

data science, machine learning, image processing, object detection and its techniques, and relevant previous research.

CHAPTER III   **RESEARCH METHODOLOGIES**

This chapter contains the explanation for methodologies utilized in research, which consist of preliminary study, literature study, problem formulation, method selection, research stages, discussion, and conclusions.

CHAPTER IV   **DATA COLLECTION & PROCESSING**

This chapter contains the explanation for collection of data, pre-processing of data, and development of machine learning model.

CHAPTER V   **DISCUSSION**

This chapter contains the analysis for the results of data collection, data processing, and machine learning model development.

CHAPTER VI   **CONCLUSION & SUGGESTION**

This chapter contains the conclusions of research, and the suggestion based on its results.