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# Self-Protection Equipment Detection System in Heavy Weight Workshop of Politeknik Negeri Jakarta Using Artificial Intelligence

**Muhammad Reza Kusuma [1], Abdul Azis Abdillah [1]*, Dewi Yanti Liliana [2], Ega Edistria [3], Samsul Arifin [4], Zahran Muzakki [5]**

[1] Department of Mechanical Engineering, Politeknik Negeri Jakarta, Depok 16425, Indonesia
[2] Department of Informatics and Computer Engineering, Politeknik Negeri Jakarta, Depok 16425, Indonesia
[3] Department of Civil Engineering, Politeknik Negeri Jakarta, Depok 16425, Indonesia
[4] Department of Mathematics, Universitas Bina Nusantara, Indonesia
[5] PT Tochterindo Prima Persada, Indonesia
*Correspondence: abdul.azis.a@mesin.pnj.ac.id

**Abstract:** The creating process, how it works and the performance of the detection system using Artificial Intelligence. The development of this innovation contributes to the Heavy Equipment Workshop of the Jakarta State Polytechnic to detect the early potential for work accidents. The methods are device tuning, inputs, training models, performance, trials and outputs. The creating process and how the detection system works using Artificial Intelligence each has 3 steps and accuracy using 3 cameras, namely the internal webcam (1MP), the JETE external webcam (720P) and the Samsung Galaxy A22 mobile phone camera (13MP). The process of making this innovation has 3 steps, namely data input, export, file grouping. There are 3 steps to work, namely open the file, run and output. The result of the accuracy of the internal webcam is very low, the JETE external webcam is better than the internal webcam and the mobile phone camera is better than the JETE external webcam.

**Keywords:** Detection system; Artificial intelligence; Input; Performance.

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## 1. Introduction

Work Accident are unplanned and unpredictable events in every company. In a large company or small one, it has to be reduced to a minimum. Work accident is an unwanted event in a certain work area, happened due to dangerous act and dangerous condition (Nur, 2019).

Data from BPJS Ketenagakerjaan reveals in 2017 work accidents reached 123.041 cases, while 2018 reached 173.105 cases, and at the end of 2021 the number is about 82.000 cases. Work accident is caused by 2 factors: unsafe act and unsafe condition. Work accident effects both on company and the workers. The company suffers on productivity and ability decrease, higher operational cost, machinery and properties breakdown, product deterioration. On the other hands, workers suffer major and minor injury, physical disability even fatality. Lack of supervision on K3 (Keselamatan dan Kesehatan Kerja, basic working safety and health condition) also contributes to the work accident occurrences. It is very obvious that the performance done by human in supervision will decrease along with time, so therefore the necessity of automation technology help is surfacing up as an ultimate solution.

In 4.0 industry era, Artificial Intelligence (A.I.) give a promising good solution. The automation system made is able to detect workers in 24/7 of K3, so that the potentiality of working accident can be early-detected.

## 2. Materials and Experiment Methods

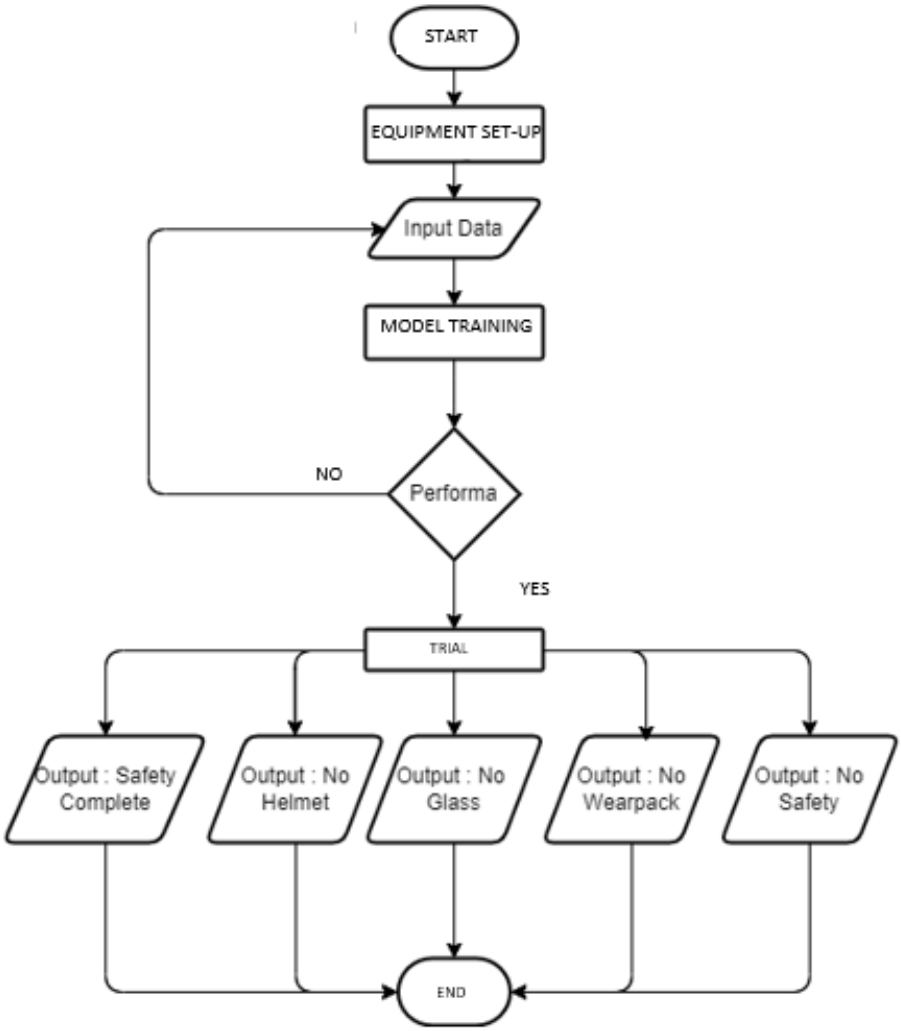


**Figure 1.** Flowchart.

Flow chart description:

A. **Equipment set-up**

The equipment set up is done by connecting the computer with the mouse and external webcam. Open the software Teachable Machine inside the computer and aim for the body part that will be captured.

B. **Input Data**

Data input is an activity of data key-in to be a set of reference models. Data input quantity needed will range from 1000 to 1100. The photo taken comprises 5 (five) major condition:

**Table 1.** Data Condition.

| No | Condition |
|---|---|
| 1 | The photo of all the personal protective equipment worn |
| 2 | Photo without safety helmet. |
| 3 | Photo without safety glasses. |
| 4 | Photo without safety outfit. |
| 5 | The photo without wearing all protective equipment. |

C. **Modeling**

Data input will be processed and calibrated by the Teachable Machine website. Their site system will be processed and calibrated into codes.

D. **Performance Measurement**

The Accuracy Measurement Method used is in format of Intersection over Union (IoU) range 0,01 until 1,00. Teachable Machine converts the decimal into percentage format. The lowest percentage is 50% (Kristal and Harintaka 2022). If below 50% it requires re-input the data.

E. **Trial Experimentation Period**

After the performance reached 50%, the model then exported onto a folder which will be downloaded to the computer. The trial experimentation period then will be commenced by re-running the model using Visual Studio Code software and Python 3.8.6.

F. **Output**

Trial result in the text output format. Output read by the system will be:

**Table 2.** Output and Condition

| Code | Output | Condition |
|---|---|---|
| 0 | *Safety Complete* | Wear all the self safety protective equipment |
| 1 | *No Helmet* | Not wearing s*afety helmet* |
| 2 | *No Glass* | Not wearing *safety glasses* |
| 3 | *No Wearpack* | Not wearing safety uniform |
| 4 | *No Safety* | Not wearing all self safety protective equipment |

## 3. Results and Discussion

Performance comparison tested by using some various camera and viewpoints.

**Webcam Internal**

Webcam Internal is the default camera installed on the computer. In this article Samsung ATIV Book with front camera 1MP is used.


**Figure 2.** Output Webcam Internal.

When the webcam is internally used, the output value is not changing. It shows 0% constantly.

**Table 3.** Webcam Internal.

| Code | Output | Detected Value |
|---|---|---|
| 0 | *Safety Complete* | 0 |
| 1 | *No Helmet* | 0 |
| 2 | *No Glass* | 0 |
| 3 | *No Wearpack* | 0 |
| 4 | *No Safety* | 0 |
| TOTAL | | 0 |
| **PERCENTAGE** | | **0%** |

Two things became the main cause possibilities of the problem. First: the camera specification is too low. Secondly: the existing code will not be able to run the camera to detect motion.

A. Webcam External

External webcam JETE W5 Series (picture resolution 720P) used. The result is far more different and better. The motion is detectable and 60% accuracy value is achieved.


**Figure 3.** Output Webcam External.

**Table 4.** External Webcam Percentage Result.

| Code | Output | Detected Value |
|---|---|---|
| 0 | *Safety Complete* | 1 |
| 1 | *No Helmet* | 0 |
| 2 | *No Glass* | 1 |
| 3 | *No Wearpack* | 0 |
| 4 | *No Safety* | 1 |
| TOTAL | | 3 |
| **PERCENTAGE** | | **60%** |

B. Cell Phone Camera

Cell Phone Camera Samsung Galaxy A22 with the front camera specification 13MP also utilized and the accuracy value reached 80%.


**Figure 4.** Output Kamera Handphone.

Gambar 4. Cellphone Camera result.

**Table 5.** Cellphone Camera.

| Code | Output | Detected Value |
|---|---|---|
| 0 | *Safety Complete* | 1 |
| 1 | *No Helmet* | 0 |
| 2 | *No Glass* | 1 |
| 3 | *No Wearpack* | 1 |
| 4 | *No Safety* | 1 |
| TOTAL | | 4 |
| **PERCENTAGE** | | **80%** |

## 4. Conclusions

The accuracy of the detection system using AI varies depending on the camera used. The variations are as follows:

1. Webcam internal computer Samsung ATIV Book 2 1MP. Accuracy percentage value 0%.
2. Webcam external JETE W5 Series 720P achieved accuracy value 60%.
3. Front camera Samsung Galaxy A22 13MP The accuracy value best achieved 80%.

Concluding the better camera resolution used the far more good result in accuracy value is achieved in the detection system.

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