# Drowsiness Detection Using Deep Learning

NTI AI&IOT TRACK FINAL PROJECT

# Team Members

## Group 2


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# Introduction

## Part 01

# Background

## Overview of the project

With increase in the number of vehicles, the occurrence of traffic and accidents is also increasing gradually. Traffic collisions are a major source of deaths every year. The National Crime Record Bureau (NCRB) reports 496,762 road-related traffic collisions in all states

A computer vision system that can automatically detect driver drowsiness in a real-time video stream and then play an alarm if the driver appears to be drowsy for the driver and his manager.

# The Problem

## What we want to solve

The main goal of this work is to determine whether a driver is drowsy or awake.

## Hypothesis

Utilization of deep learning architectures will enhance the accuracy of both face detection and drowsiness detection.

# Our Data

## Part 02

# Data Collection

## Which Datasets we used?

**Driver Drowsiness Dataset:**
Extracted and cropped faces of drivers from the videos of the Real-Life Drowsiness Dataset. The frames were extracted from videos as images using VLC software. After that, the Viola-Jones algorithm has been used to extract the region of interest from captured images.

**yawn_eye_dataset:**
A dataset of 2900 sample image divided into 4 categories closed_eye, open_eye, yawn, and non_yawn it's used to predict drivers drowsiness throw these features.

**Drowsiness Prediction Dataset:**
A dataset of 2900 sample image has two labels: Fatigue which tends to drown and Active which is not.

**NITYMED**
130 videos, captured in Patras, Greece, displaying drivers in real cars, moving under nighttime conditions where drowsiness detection is more important.

# Data Sequence

The avilable three data sets that have been mentioned didn’t give us the required accuracy in this application so we tend to generate our custom data set.

# Data Sequence

## yawn_eye_dataset

Only the two folders of yawn and nonyawn were used.

## NITYMED dataset

frames extracted from the dataset’s videos were preprocessed and used as a supplementary data for better learning

## MTCNN Face Extraction

MTCNN (Multi -Task Cascaded Convolutional Neural Networks) for cropping faces from images to be easy for the model to learn.

# Data Preprocessing

- Turning Video Inputs into images frames
- Face Recognition and extraction
- Resizing the images
- Data Augmentation

# Data Augmentation

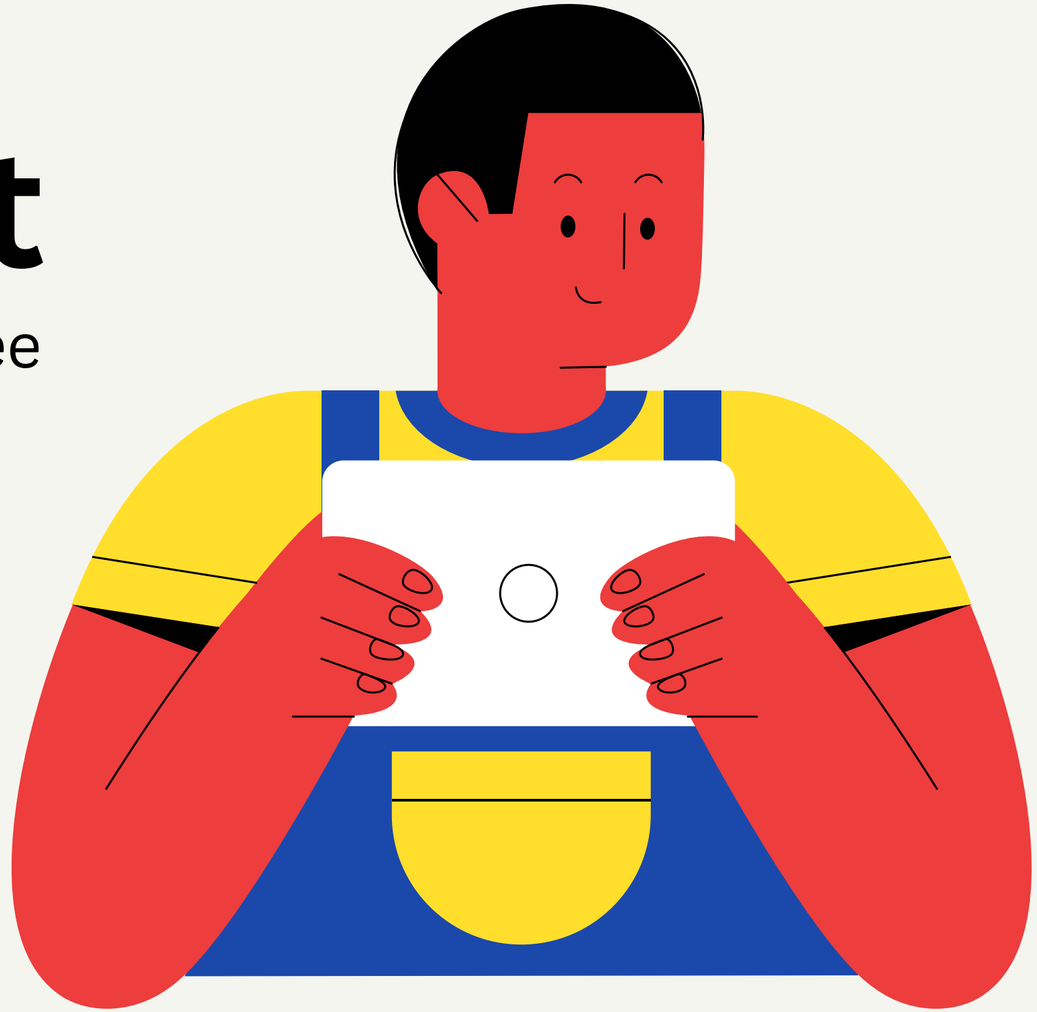
- Based on our experience, it is not the good choice for this data set.
- Our data is augmented and used for the model training but it results with a bad test accuracy in the real time.
- So, in our work we relyed on the original data set without augmenation.

# Final Data Set

The generated data set contains three classes :

- Active : 1583 Images
- Sleep :1283 Images
- Yawn : 1011 Images

## Data Link



# Transfer learining using different models for best model selection

**Resnet50**

20 EPOCHS

TRAIN:.75
VALID:0.74
TEST:0.73

**Resnet152.**

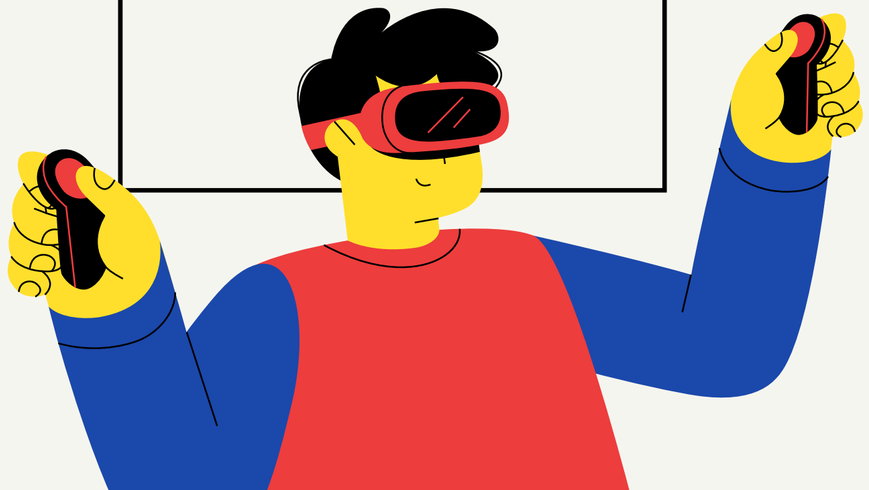
20 EPOCHES

TRAIN:0.942
VALID:0.934
TEST:0.541

**INCEPTIIoNV3**

20 EPOCHES

TRAIN:0.8239
VALID:0.8062
TEST:0.727



# Transfer learining using different models for best model selection

**DenseNet121**

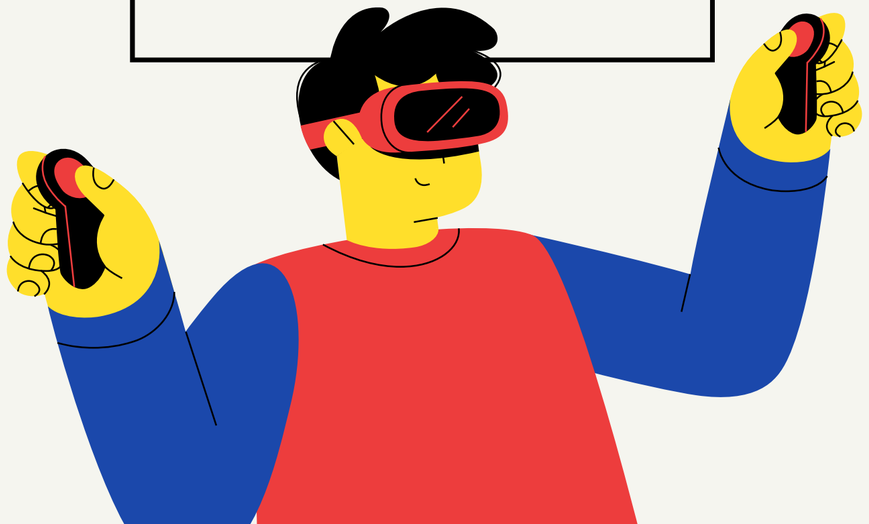
*TRAIN:0.82*
*VALID:0.81*
*TEST:0.73*

**Xception**

*TRAIN:0.88*
*VALID:0.85*
*TEST:0.79*

**VGG16**

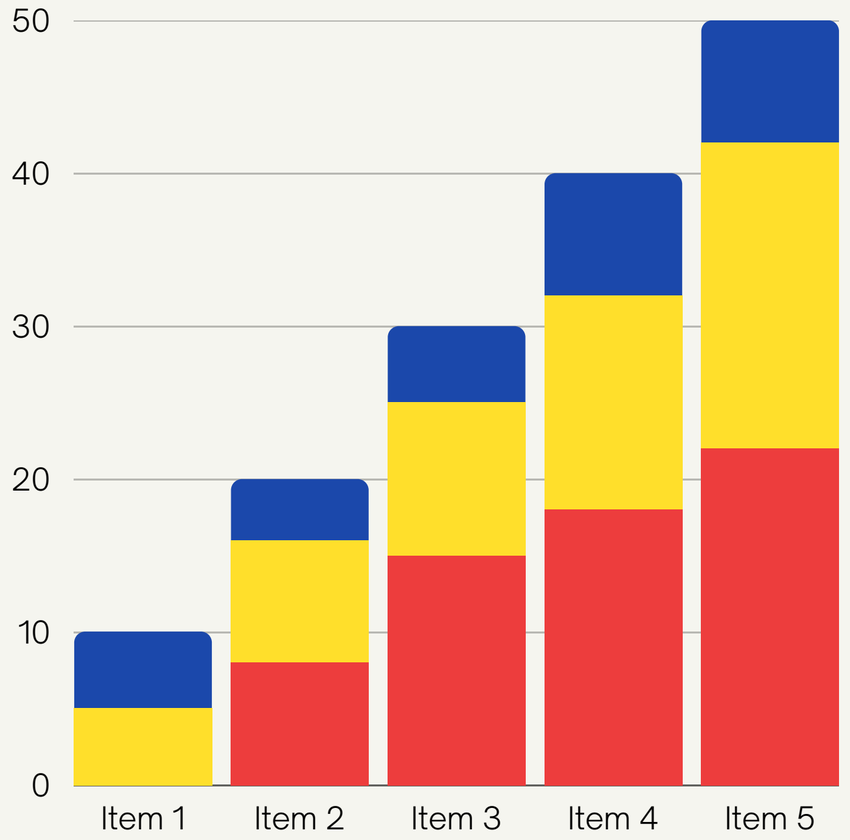
*TRAIN:0.9483*
*VALID:0.9207*
*TEST:0.899*



# Best Model

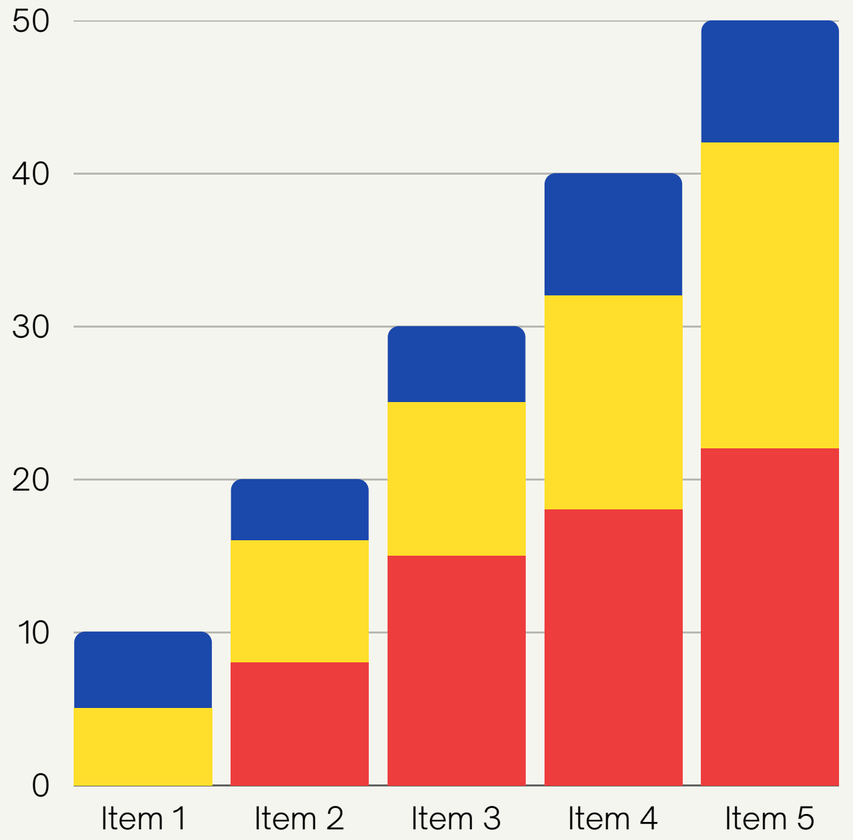
- After we use all this models we find that **VGG16** is the most suitable model for our problem with the highest accuracy.

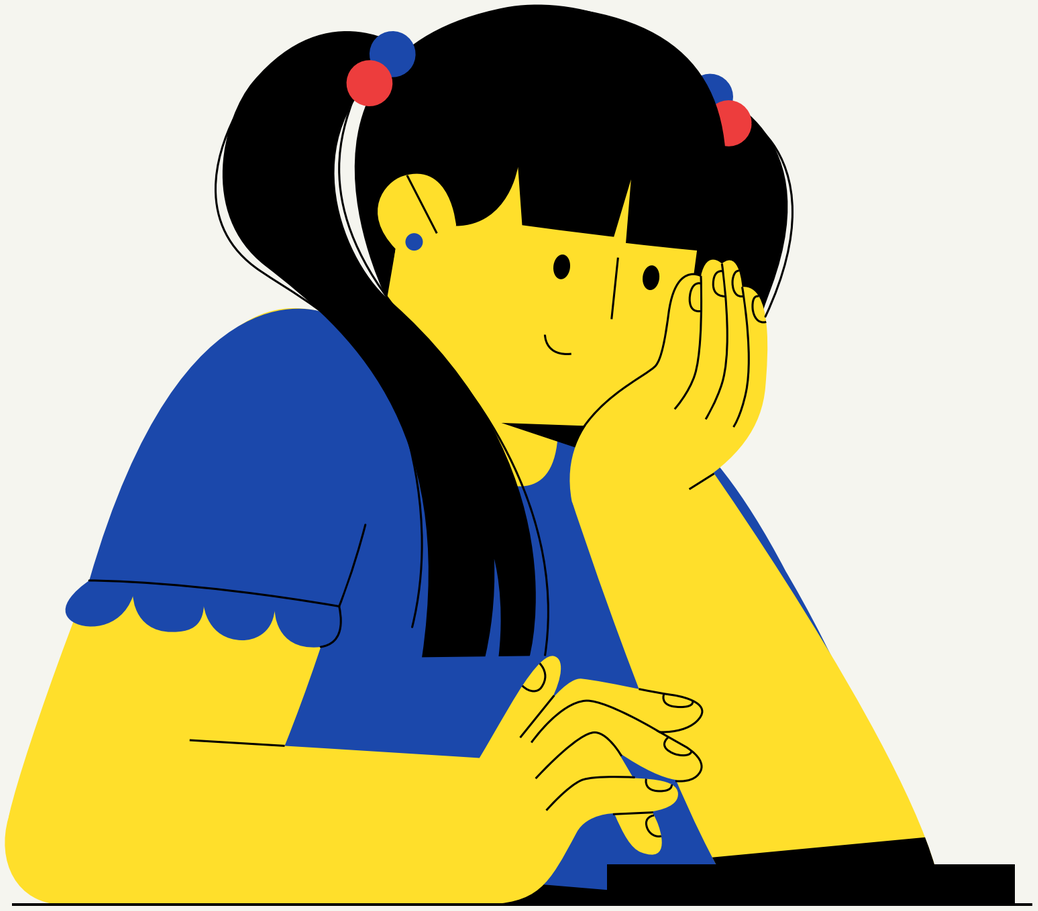
- Based on transfer learning, the model is followed by two dense layers, one drop out layer and out output layer of three softmax activated nodes.



# Accuracy & Training Environment

- Training has been done on the generated data set for 30 Epochs using Google Colab free T4 GPU resources.
- Training has ended with the following accuracy:
    - Training: 99.51%
    - Validation: 94.95%
    - Testing: 96.22%





# Deployment

## Part 03

# Realtime Processing & Prediction

## Camera Usage

.Model was used to make prediction in real-time processing by accessing laptop camera though Google Colab notebook, every 0.5 second an image is token.

## Your video

You can use your driving viedo for testing, five frames are token of your viedo each 3 seconds a frame is token.

## Decision making

5 frames are taken from the camera then the model run on them to predict the result whether the subject is asleep, awake or going to sleep

## Output

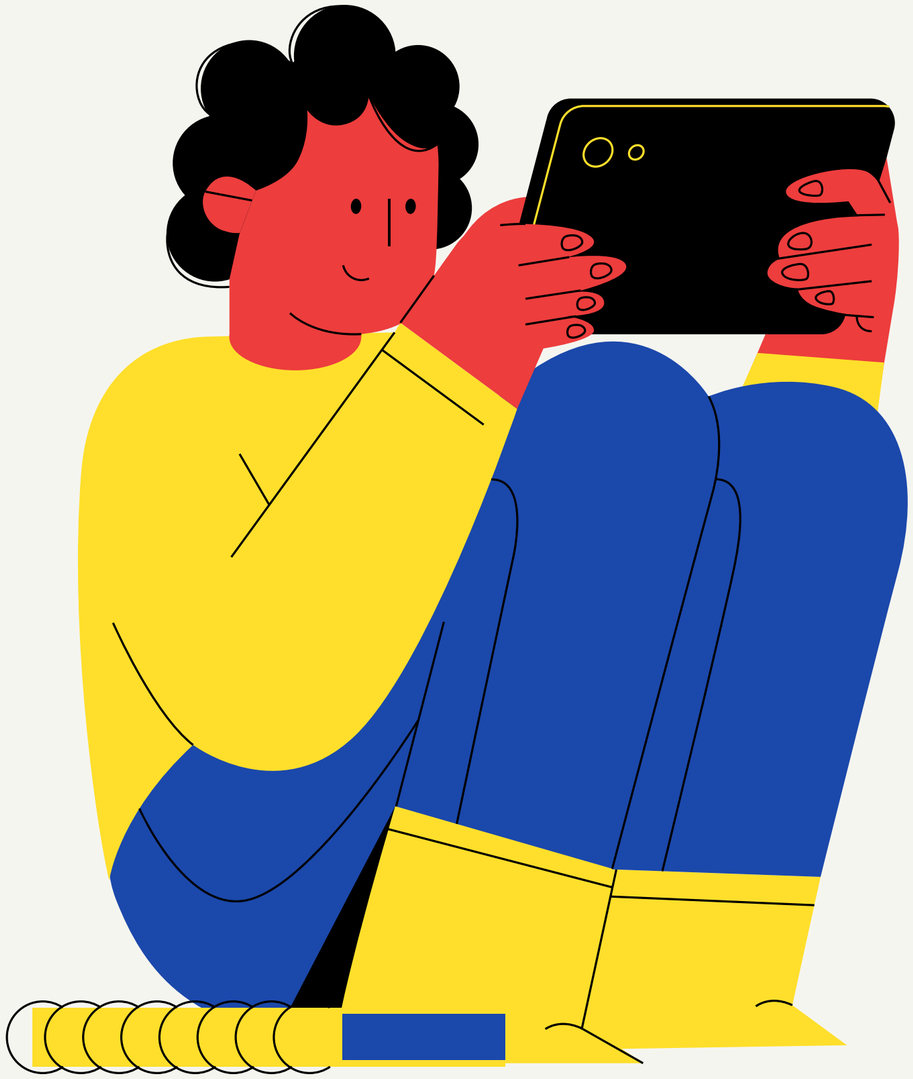
Based on the prediction a message output is generated, and sent to the driver’s car to start the alarm if it is needed and to the driver manger for monitoring.

# Decision Making

Drowsy driver:
sleep in two followed frames or yawning in one frame and sleep in the following frame

Driver is going to sleep :
yawning in two following frames

Awake driver :
No sleep No yawning in two following frames



# IoT integration

## Server Connection

The message output is uploaded on a server to a specific topic.

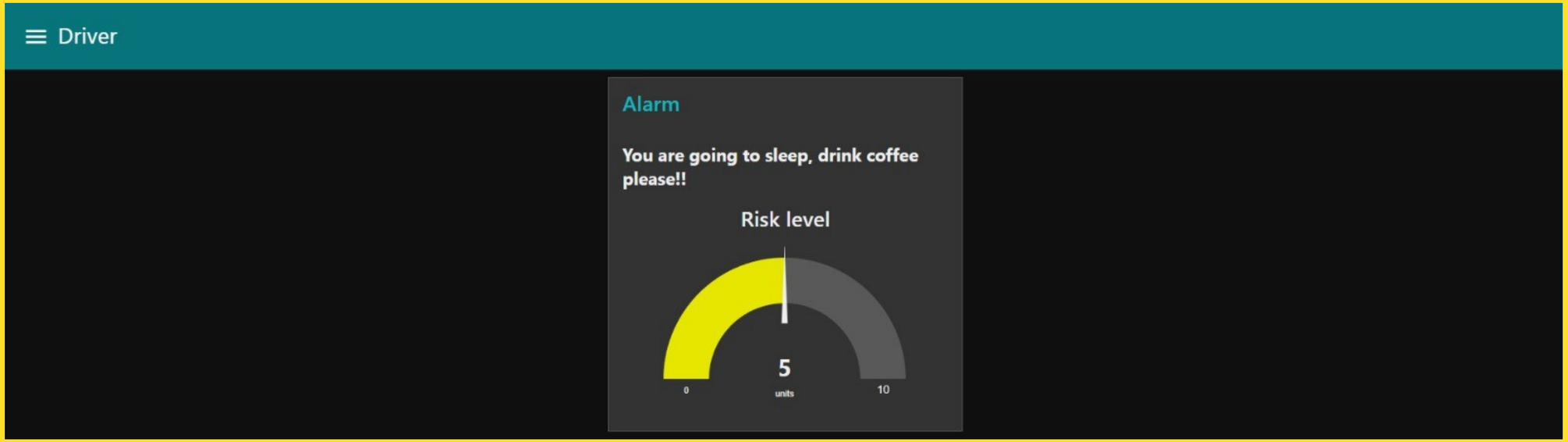
## Received Message

Any IoT device can be connected to the server and receive the message from it

## Action

Based on the message sent from the model, the driver status is monitored by his manager and an action is taken in the driver car (Alarm is going on ) if he is going to sleep and a gauge is connected for the risk level.

# Monitoring inside the driver’s car



# Monitoring for the driver’s manager