

SUMMER INTERNSHIP

on AIoT AND IT'S APPLICATIONS



AIoT-Based Mental Fitness Detection System

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Abstract

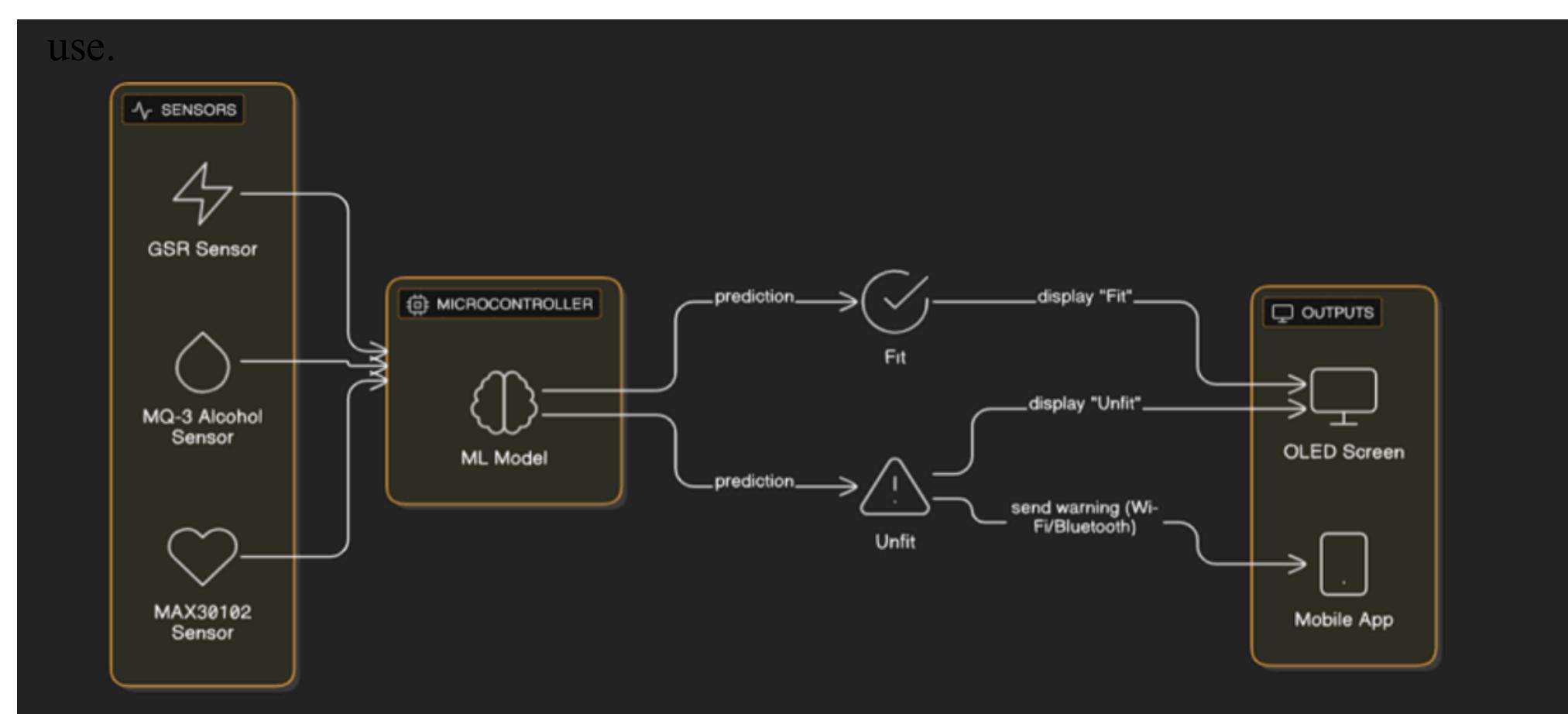
Cognitive and physical impairment resulting from the consumption of substances may have hazardous repercussions when performing activities that involve driving, operating heavy machinery, or arriving at significant decisions. Conventional methods of detection basically utilize measurement of blood alcohol concentration (BAC) using tools such as breathalyzers. Since personal tolerance varies from one individual to another, BAC is insufficient to pinpoint an individual's mental competence. This work proposes an AIoT-multi-sensor system that measures a set of physiological and cognitive parameters to decide whether an individual is fit or not under the influence.

Problems Identified :

- To develop a real-time AIoT-based mental fitness detection system that integrates alcohol sensing and biomedical signal monitoring (heart rate, SpO₂, GSR, reaction time), using an ESP32 and machine learning model to accurately assess a person's cognitive fitness under the influence of alcohol and other medical or psychological conditions like stress or anxiety.

Novelty :

- Uses multi-sensor fusion (Alcohol, GSR, Heart Rate, SpO₂, and Reaction Time).
- Employs AI-based classification model to determine "Fit" or "Unfit" rather than just reporting alcohol level.
- Focuses on mental fitness, not just intoxication.
- Designed as a low-cost, portable prototype suitable for vehicles, industries, or personal use.



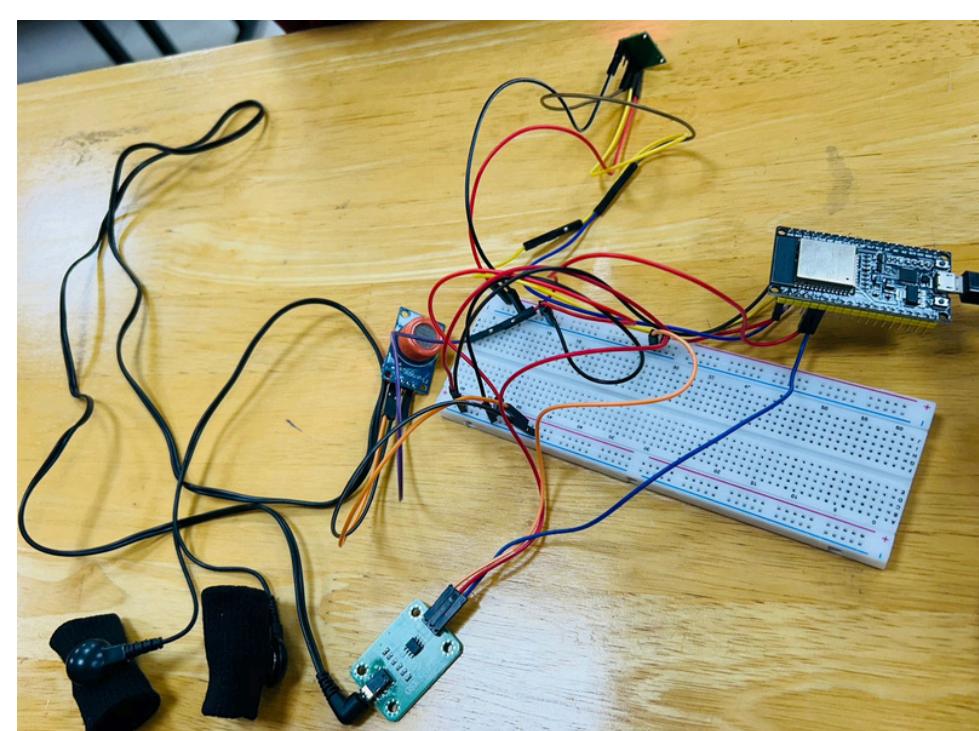
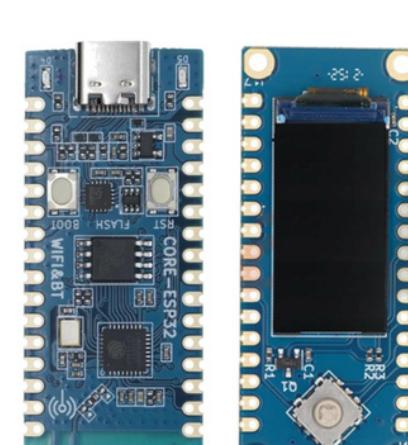
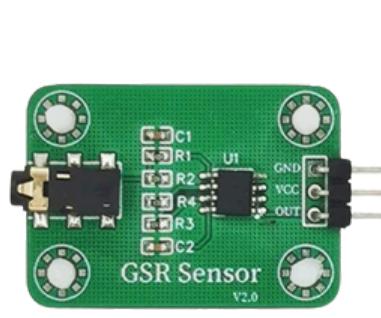
Hardware Components

MQ-3 Sensor

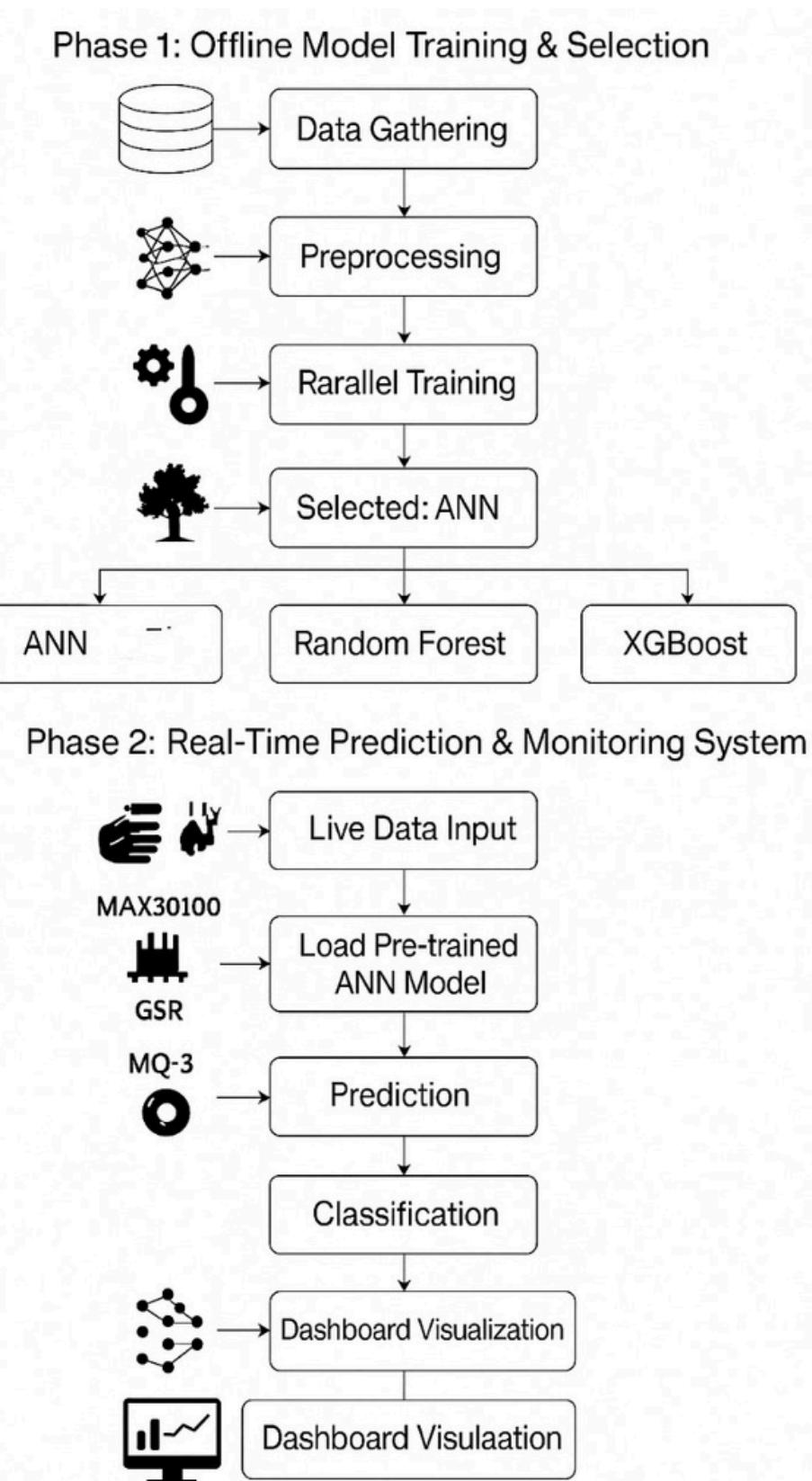
MAX30102

GSR Sensor

ESP32



ALGORITHM :



Objective Test Results

```
Output Serial Monitor X
Message (Enter to send message to 'ESP32 Dev Module' on 'COM6')
Heart Rate (BPM) : 61.58
SpO2 (%) : 95.00
Alcohol Level (Normalized) : 0.562637
GSR (Normalized) : 0.005372
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♥ Beat detected!
```

Conclusion

In a world where a single moment of impaired judgment can cost lives, this AIoT-based mental fitness detection system offers a novel and intelligent approach to evaluating an individual's cognitive and physiological state under the influence of alcohol. By integrating multiple sensors—such as alcohol, GSR, heart rate, SpO₂, and reaction time—and utilizing machine learning algorithms, the system goes beyond traditional alcohol detection methods that rely solely on BAC levels. It provides a comprehensive assessment of mental fitness, taking into account individual variability in tolerance and response. The solution is low-cost, portable, and adaptable for various applications, including driver monitoring, industrial safety, healthcare, and military readiness. Overall, this system holds great potential in enhancing public safety and promoting responsible decision-making in alcohol-influenced situations.

Acknowledgement

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References

- "A Lightweight In-Vehicle Alcohol Detection Using Smart Sensing and Optimizable Shallow Neural Network" (MDPI Computers 2022) Used MQ-3 sensors and an SNN to classify intoxicated states. Focused only on alcohol levels.
- "A Transdermal Alcohol Sensing and Machine Learning-Based Model to Predict Alcohol Intoxication Level" (IEEE Access) Used skin-based alcohol sensing + ML models. Highlighted variability in personal alcohol tolerance.