IFS DriverAlert

User Manual

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Table of Contents

List of Tables

List of Figures

1.0 Preface

1.1 Description of the User

- This product is intended to be used by drivers or vehicle operators who want to monitor and enhance safety by detecting signs of drowsiness or fatigue during driving.

1.2 Conventions Used in this Manual

- In this document, the reference; "RPi" is used for "Raspberry Pi 5".
- In this document, the reference "system" is used for "IFS DriverAlert".

1.3 Explanation of Safety Warnings

Label	Warning	Prevention
DANGER! ELECTRIC SHOCK	Shock	- Do not touch exposed wires. - Do not connect random wires to the product.
	Flammable	Short circuit may cause a fire, in this case please turn off the product and put off the fire.
	Hot Surface	If any component becomes hot; turn off the product.

Table 1: Safety Warnings

2.0 Ordering Information

- This product is not in the market as of right now, but can be produced at any time.

3.0 Quick Start

3.1 Getting started

- Power on the system by connecting the system to the car's power supply.
- The camera should be positioned straight without any tilt or angle. It does not need to be exactly in the center of the driver's view; it can be placed to the left, right, or in the middle. However, regardless of its position, the camera must remain parallel to the driver's line of sight. This means the camera's forward facing direction should not intersect or cross the driver's straight-ahead view.
- Leaving the switch on "Auto" is a convenient way for the driver to not keep interacting with the system. When the switch is "Auto", the detection system will work automatically when the car speed is 20 km/h or more.
- When the switch is "Auto" and the speed is not detecting, an audio alert will be playing every 10 minutes to recommend the driver to manually turn detection on.
- When a drowsiness sign is detected, an audio alert will play to alert the driver.

3.2 Operating Environment

- Designed for use inside a car and operates optimally between -20°C and 50°C.
- Avoid exposure to direct sunlight for extended periods or immersion in water.

3.3 Services

- Monitoring the driver's face.
- Alert the driver through a speaker when closed eyes, yawning or looking away is detected.
- Play an audio reminder every 10 minutes if the system is disabled.

3.4 Product limitations

- Since the product is designed to stay in the car; when the temperature goes below -20°C, the system components may require 5 to 10 minutes to warm up after the vehicle is started before becoming fully operational.

4.0 Electrical Connection

This section dives into the details of the electrical connections of the system, providing a comprehensive overview of how each component is interconnected to ensure seamless operation and functionality. By examining the block diagram, schematic diagram, detailed connection table and Components table, you will have a clear understanding of the system's electrical architecture and component interrelationships. This section is crucial for replicating the setup or diagnosing system issues, offering a foundation for both theoretical understanding and practical application.

4.1 Block Diagram

The Block Diagram provides a high-level overview of the system's main components and their primary connections. This visual representation serves as a foundational guide, showing the system's functional relationships and signal flow between components, helping in the overall understanding of the system's electrical design.
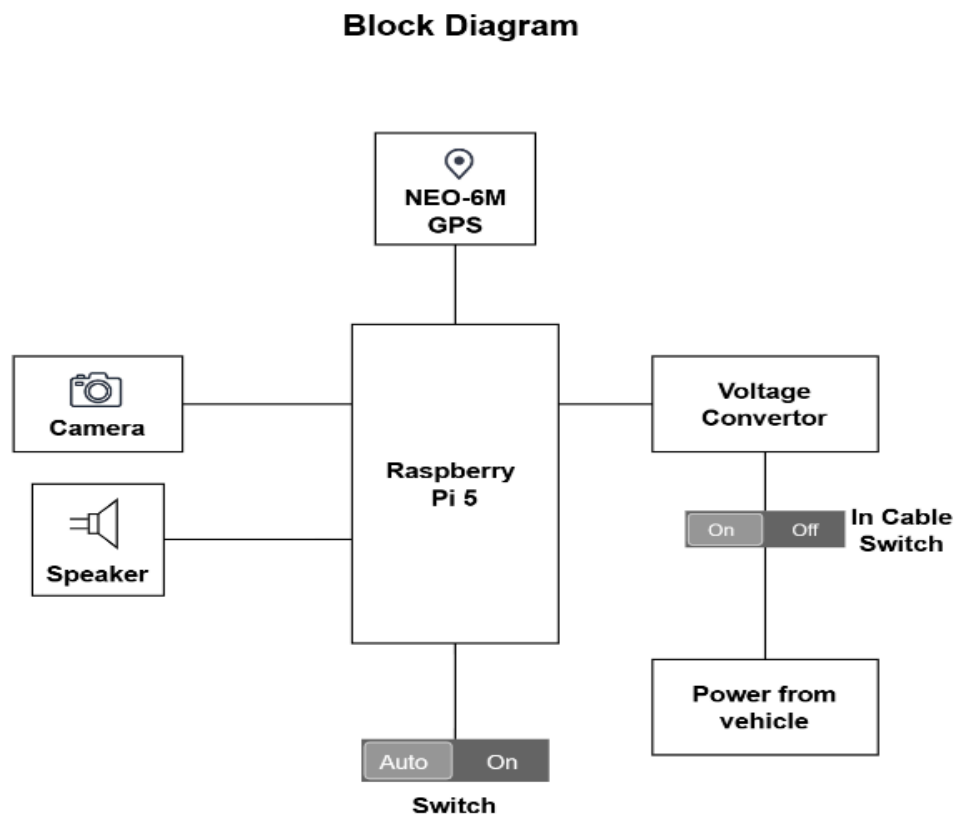

Figure 1: Block Diagram

4.2 Schematic Diagram

Following the block diagram, the Schematic Diagram provides a detailed view of the electrical connections within the system. It includes specific connections, component values, and circuitry details essential for constructing the system. This diagram is essential for understanding the complex wiring and component integration as it acts as a map for the electrical design.
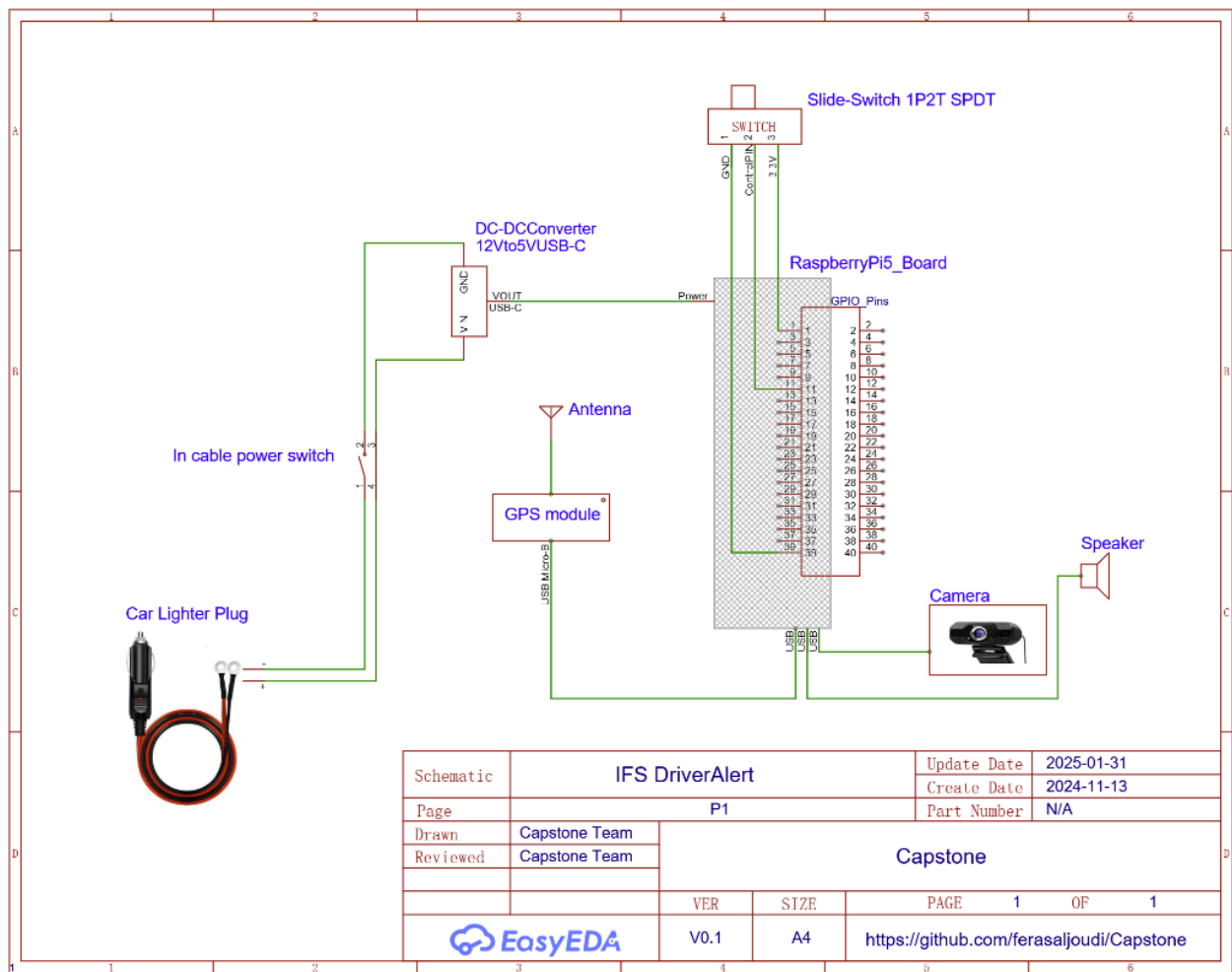

Figure 2: Schematic Diagram
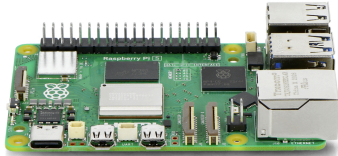
4.3 Connection Details for Components

This table provides detailed information of the connections in the system. It lists each component, its corresponding pin/cable, and how it is connected to the RPi. These details are essential for ensuring accurate connections for proper functionality.

Pin/Cable	Connected to
Main Components	
RPi power (USB-C)	DC-Converter USB-C
Camera USB	RPi USB
Speaker USB	RPi USB
NEO 6M GPS	RPi USB
Slide Switch	
Pin 1	RPi 3.3 V
Pin 2 (Middle Pin)	RPi GPIO17
Pin 3	RPi GND
DC-Converter	
USB-C (Output)	RPi power (USB-C)
12 V	Cigarette Lighter Adapter Cable 12 V
GND	Cigarette Lighter Adapter Cable GND
Cigarette Lighter Adapter Cable	
Cigarette Lighter Adapter Plug	Car Cigarette Lighter Socket

Table 2: Connection Details

4.4 Components Used

The final table in this section lists all components used in the system, along with their specifications. This table is essential for accurate component sourcing and ensuring compatibility within the system.

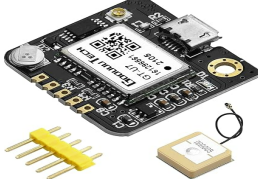| Image	Description
	Raspberry Pi 5 Microcontroller to control the system.
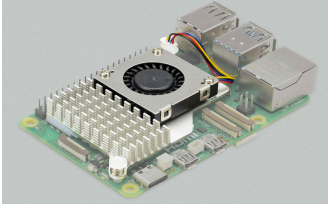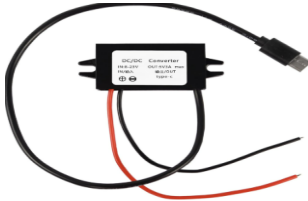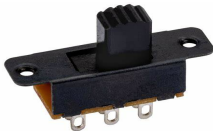
	Raspberry Pi 5 Active Cooler The Active cooler is connected to the fan port of the RPi. It is important to maintain the temperature of the RPi.
	Cigarette Lighter Adapter Cable This will provide 12 V from the car to the DC-Converter.
	DC-Converter 12V to 5V converter used between the car power and RPi.
	NEO 6M GPS This will be used to detect the speed of the car.
	USB Stereo Speaker Used to play audio alerts and reminders.
	Webcam Used to capture the driver's face in real-time for monitoring.
	Slide Switch Used to enable/disable the system.

Table 3: Components Used

5.0 Operation

5.1 Operating Modes

- **Active Monitoring Mode:** When the system is switched "On", or when it is switched "Auto" and car speed is 20 km/h or more. It continually monitors the driver's face for signs of drowsiness or fatigue. Alerts are triggered based on detections.
- **Disabled State:** When the system is switched "Auto" and car speed is less than 20 km/h. The system will also be disabled when it is switched "Auto" and car speed is not detected. In that case, an audio reminder plays every 10 minutes to inform the driver that the speed is not detected and encourage manually enabling the system for safety.

5.2 Alerts

The alert system is designed to progressively warn the driver based on repeated detection of signs of drowsiness or distraction. When a sign (eye closure, looking away, or yawning) is detected for the first time, a low volume alert is played. If the same sign is detected again within five minutes, the first alert is repeated at a higher volume. If the same sign is detected a third, fourth, or more times within the same five minutes, a second, more urgent alert is played at a higher volume. The alerts types are below:

- **Enable Confirmation:**
  - Triggered when the system is switched on to inform the driver that the system is on.
  - Alert Message: "The detection system is on".
  - No action needed.
- **Eye Closure Alert:**
  - Triggered if the driver's eyes remain closed for more than 1 second.
  - Alert Messages:
    - "Please focus on the road".
    - "Closed eyes detected! Stay focused".
  - Action needed: The driver should refocus on the road immediately.

- **Yawn Alert:**
  - Triggered if the driver's mouth remains widely open for more than 2 seconds.
  - Alert Messages:
    - "Consider taking a break".
    - "Yawning detected! Take a rest soon".
  - Action needed: The driver is advised to take a break to stay alert.
- **Looking Away Alert:**
  - Triggered if the driver looks away (left/right) for more than 3 seconds.
  - Alert Messages:
    - "Eyes on the road!".
    - "You're looking away! Please focus on driving".
  - Action needed: The driver should refocus on the road immediately.
- **Disable Confirmation:**
  - Triggered when the system is switched off to inform the driver that the system is off.
  - Alert Message: "The detection system is off".
  - No action needed.
- **System Reminder:**
  - Triggered every 10 minutes if the system is disabled.
  - Alert Message: "Auto detection is off, consider turning it on manually".
  - Action needed: The driver should switch the system on to ensure monitoring.

5.3 Maintenance

- **Cleaning:**
  - Gently clean the camera lens weekly to remove dust or smudges.
  - Inspect the speaker for dust accumulation and wipe it clean as needed.
- **Extreme Weather Tips:**
  - In very cold weather (-20°C or lower), allow the system to warm up for 5-10 minutes after starting the car.

6.0 FAQ

1. **Will the system work if the driver wears glasses?**
   a. Yes, the system is designed to work effectively even if the driver is wearing glasses.

2. **Can I replace the camera or speaker if they are damaged?**
   a. Yes, both the camera and speaker are USB devices, making them easy to replace. Simply unplug the damaged component and connect a new one. Ensure the new camera is high resolution for best detection.

3. **What happens if the detection is on, but the driver doesn't close eyes, yawn or look away?**
   a. The system will remain in active monitoring mode and will not trigger any alerts until it detects drowsiness signs.

4. **Is my face or the data detected by the camera saved or stored?**
   a. No, the system does not save, store or transfer any data. All detections are processed in real-time and discarded immediately.

5. **Will the camera detect other faces behind or beside the driver?**
   a. No, the camera is configured to focus only on the driver's face to ensure accurate monitoring without interference from other passengers.

7.0 Additional Resources

For detailed information on Raspberry Pi 5 information, check the official website https://www.raspberrypi.com/news/introducing-raspberry-pi-5/.

For further details, please visit the GitHub repository https://github.com/ferasaljoudi/Capstone.

To see the system in action and understand its operational flow, watch the demonstration on YouTube "Coming Soon…".