Drowsiness Sensing Rear-View Mirror

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SCAN ME

1. Motivation

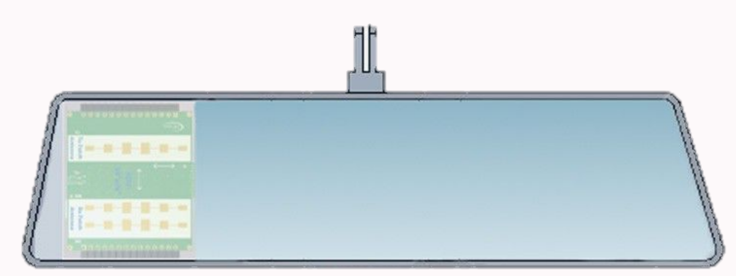
Given the frequency of accidents due to drowsy driving, how can we alert drivers when they get too drowsy and improve upon current autonomous safety features to prevent further accidents? Driving, a necessity for many, can be very dangerous on any given day. It does not matter how careful one is driving, another person on the road may not be. This is also exacerbated by the toll of day-to-day responsibilities. This is significant because driving drowsy will statistically lead to more accidents, and thus, more deaths. To address this issue, there should be a way to detect drowsiness in a driver and allow their vehicle's autonomous safety features to take over if they are getting too drowsy to drive.

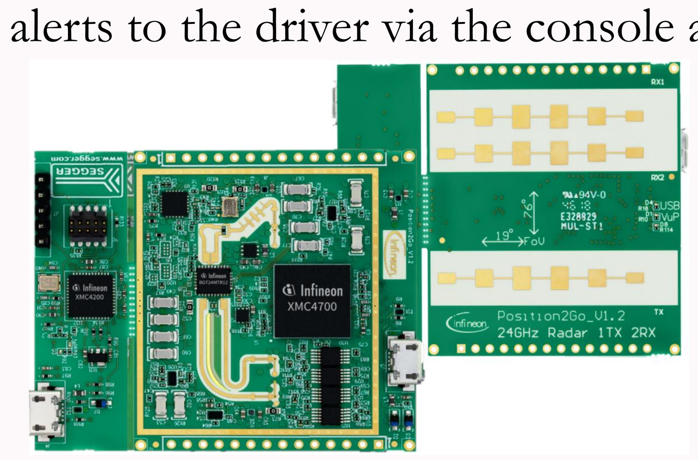
2. Project Goal

1. Develop algorithm for drowsiness detection
2. Develop an alert notification system
3. Design housing for required hardware
4. Achieve a detection rate of 30%

3. Finished Design

Infineon's POSITION2GO radar system is used to capture the driver's biometrics and perform the calculations to determine drowsiness. A compact rear view mirror created with a 3D printing filament houses the POSTION2GO board. The radar will not be completely covered by the mirror glass to ensure viable operation of the transceiver. Data extraction and processing of the driver's biometrics is performed in the MATLAB environment. Additionally, MATLAB is used to create the Bayesian network which uses known probabilities of certain events to determine drowsiness and output alerts to the driver via the console and the "sound" function.





4. Extracting Biometrics

Preprocessing:

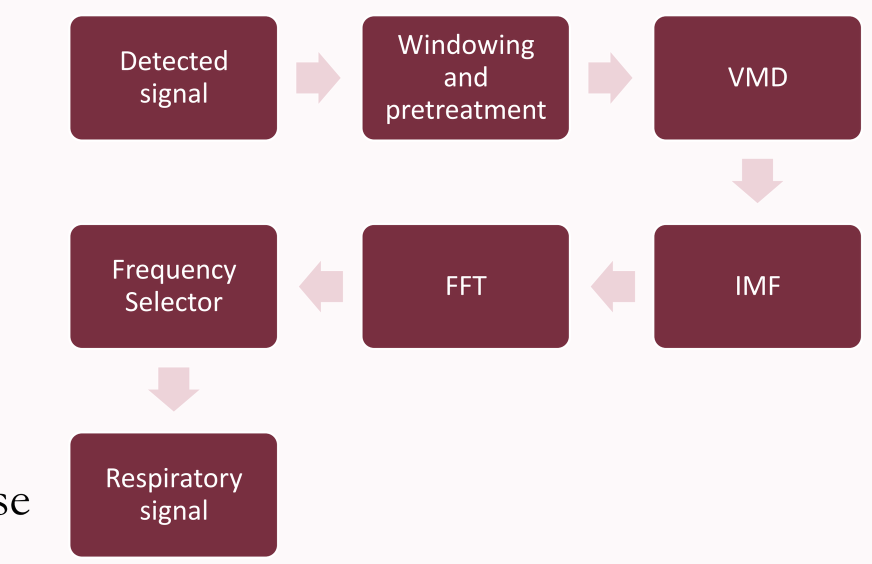
the raw data from the radar was processed to remove unwanted noise. Some of these processes include windowing and using either low pass or high pass filters.

Frequency analysis:

The signal is split into multiple sub signals based on their frequency components Afterwards, the desired frequency was found by taking the Fourier transform of the time domain signal.

Outputting to Algorithm:

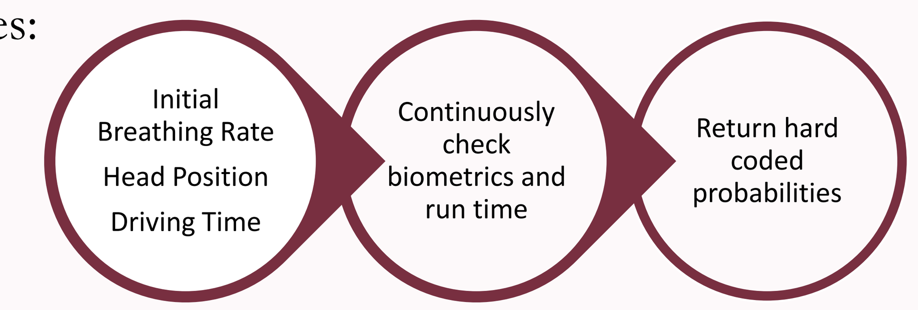
A calibration stage was used to determine base levels of drowsiness and then these values of head state and respiration rate are fed into the Bayesian network.



5. Drowsiness Algorithm

The current variant of the drowsiness detection algorithm takes:

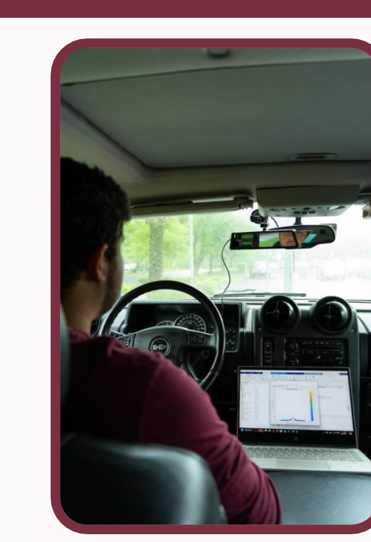
- initial breathing rate
- head position
- driving time

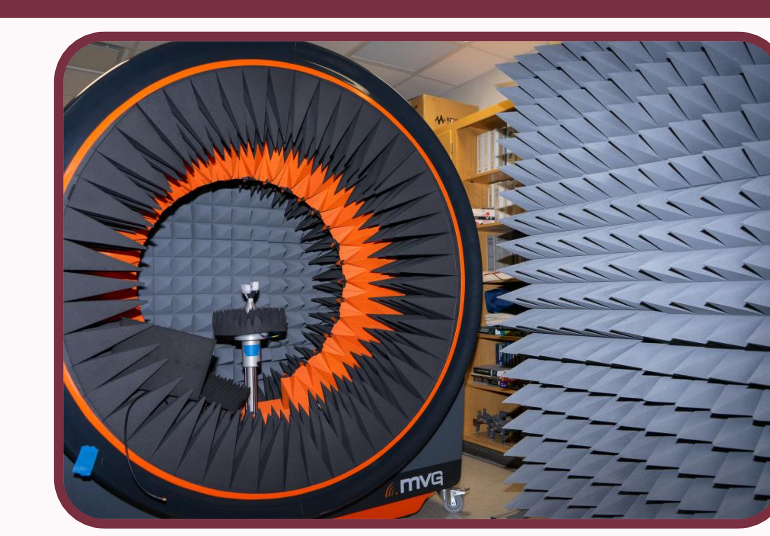


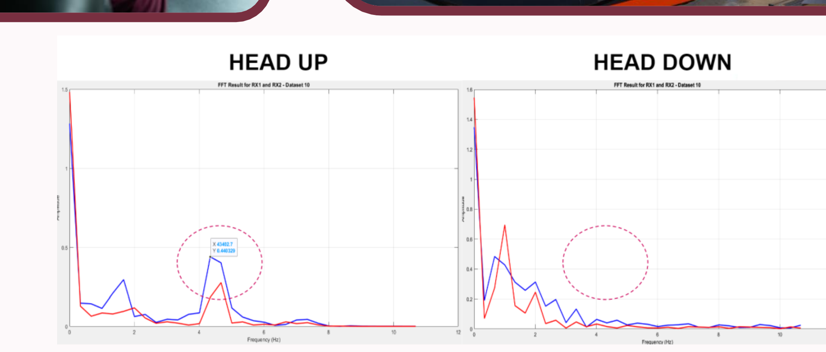
The baseline biometrics are established within the first 10 seconds of the start of the device. Then we continuously poll our biometric information to check for updates as well continuously update the clock. Finally, we return hard coded probabilities dependent on the three features.

6. Testing

Before testing the accuracy of the algorithm, a reliable range measurement needed to be obtained. An anechoic chamber pictured in this section created an environment free from electromagnetic noise allowed us to get this range measurement. To mimic a real-world environment, the design was tested inside a stationary car. Furthermore, team members mimicked the signs of drowsiness for every testing scenario. A respiratory belt is used to collect breathing data while the head position can be easily observed during testing. The desired detection rate of 30% was achieved.







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