Advanced Vehicle Emergency Response System

VOLTY

THE PROBLEM

Vehicles are becoming more advanced as they incorporate emerging technologies and the push for increasingly autonomous operation intensifies. Many of these technologies aim to reduce the chances of a crash or, when a crash occurs, reduce its severity. Although these improvements in vehicle safety have reduced crash rates, crashes still occur. Road accidents and the resulting fatalities are an important societal and economical problem. More than 6 million car accidents occur in the U.S. each year, and according to the NHTSA, about 6% of all motor vehicle accidents in the United States result in at least one fatality. About 90 people die every day in the U.S. from vehicle accidents.

When crashes do occur, particularly those of higher severity, occupants rely on emergency medical services (EMS) for a rapid and efficient response that provides them with initial treatment and transportation to a medical facility. In performing their tasks, however, EMS personnel encounter many challenges and difficulties including those inherent in identifying injuries and providing treatment to the victims. In particular, they experience difficulties related to lack of or inaccuracies in information, interactions with traffic, incompatibility in communication technology, scene safety, resource management, and obtaining timely notifications of motor vehicle collisions. Regarding the type of information most needed to improve emergency medical response, the desire for additional data related to the vehicle and its occupants is paramount. Data inaccuracies (or lack thereof) can adversely affect the quality and effectiveness of the EMS response to a vehicular crash.

THE SOLUTION

Most vehicles today have an array of sensors incorporated into their seats that relay data that is used to improve the driver (and occupants) experience while in the vehicle. From pressure sensors which determine whether someone is currently sitting on the seat, to position sensors that determine the current position (and configuration) of the seat, to heating elements for heated seats, the current sensor framework for vehicle seats is quite robust and thus can accommodate an array of proposed advanced automatic collision sensors.

Incorporating additional vehicle seat sensors designed to measure an occupant's vital signs including respiration and heart rate, as well as whether the seatbelt is currently engaged and how much additional physical pressure is being exerted on the occupant's body, is well within the realm of current technical feasibility. Once a vehicle is involved in an accident, these sensors are triggered and they begin to relay the occupant's vital signs to an emergency response team in order to help better inform and improve their response. With this framework in place, EMS teams en-route will be able to access a data feed that relays a direct reading of the occupant's medical state. With that information, they can better assess the situation and prepare for the actual conditions on the ground as opposed to having to figure it out once they arrive at the scene.

THE CONCEPT

Injury Prediction System

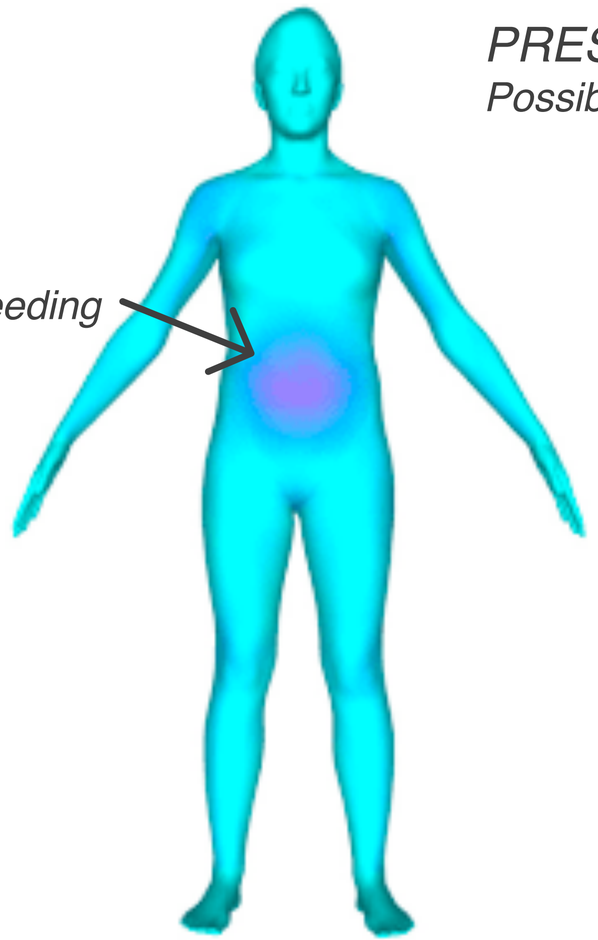
The solution proposed in this project to address the stated need is a non-intrusive sensing system embedded in the seat (or seat cover) and the safety belt of a car. It will detect the mechanical effect of heart and respiration activity, filter and cancel the noise and baseline conditions expected in a vehicle i.e. vibration and body movements, and calculate the relevant parameters, which will be transmitted in a readable format to an advanced EMS response system. This sensing system will also include pressure and other haptic sensors like a seatbelt detector, to create a 3D presentation of the occupant's current biological, mental, and physical state.

All put together, the system can create an injury prediction metric based on the data collected and also produce predictive injury risk analysis per affected body regions for specified accidents. Theoretically, the injury detection algorithm could be combined with the vehicle's electronic data recorder (EDR) outputs in real-time to provide EMS with an initial assessment of potential injuries sustained by occupants during an accident. This predictive algorithm can also be influenced by occupant biometric details such as age, height, and weight.

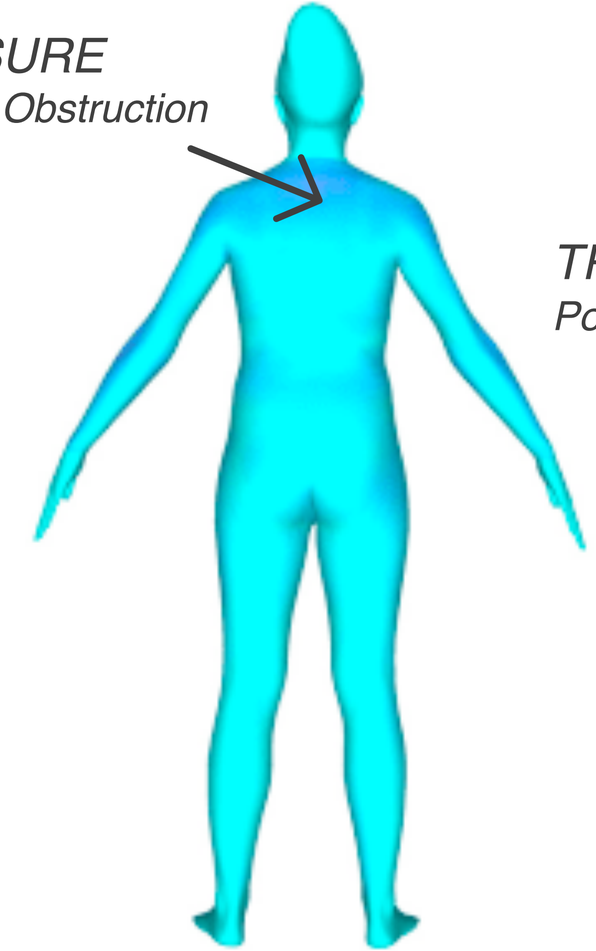
THE DATA

Injury Prediction System - Dashboard

TRAUMA
Possible Bleeding



PRESSURE
Possible Obstruction



TRAUMA
Possible Bleeding

BP: 120/80
HEART RATE: 60
PULSE: 67
RESPIRATION: 72
TEMP: 37˚C
WEIGHT: 207 lbs
FIRE: NO
SEATBELT: YES

THE METHODOLOGY

Step 1. Built-in seat sensors to measure vital signs

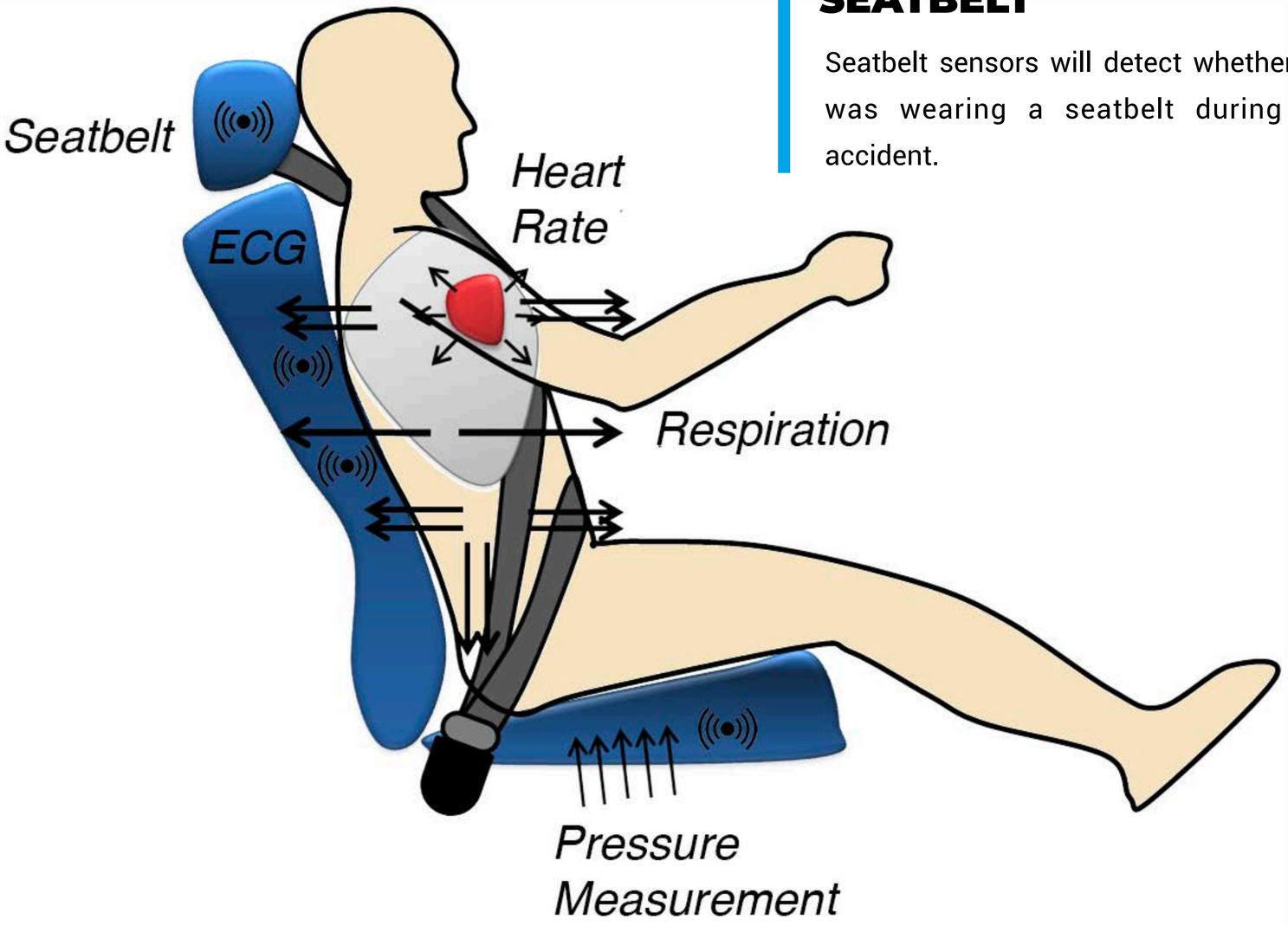
The product has three principal components: the sensing seat (or seat cover), the sensing safety belt, and the CPU that will process and transmit the data.

Step 2. Relay data to an advanced EMS response system

The data collected once processed and ran through the algorithm will then be transmitted to a compatible advanced EMS response system, allowing EMS personnel en-route to access real-time intelligence and insights about the accident, the vehicle and most importantly, the occupant(s).

This data can also be relayed to (in real-time our post-accident) insurance companies to better assess pending claims that will arise from the incident.

THE DESIGN



SEATBELT

Seatbelt sensors will detect whether the was wearing a seatbelt during the accident.

HEART RATE

A heart rate sensor positioned directly behind the occupant's upper chest will detect the occupant's heart rate.

RESPIRATION

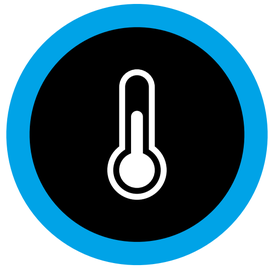
A sensor positioned directly behind the occupant's lower chest area will detect the occupant's respiration pattern.

PRESSURE

This sensor will detect the amount of unusual/additional pressure being exerted on the seat which could be an indication of a physical obstruction affecting the occupant's condition.

FUTURE PLANS

Blood Sensor: Fiber-based optic sensors are capable of detecting a clump of blood in the bloodstream and also determining where the blood is pooling on the seat. This information can be used to create a mobile diagnostic that can predict how much trauma and what part of the body has sustained the most trauma.



Fire/Temperature Sensor: Temperature sensors can be integrated into the seats to detect the occupant's current body temperature and the surrounding area. When coupled with smoke detection, the system will be able to accurately relay whether the vehicle is currently on fire.

Medical Records Access: Having access to the occupant's medical records will allow EMS personnel to better plan for treatment knowing what medications and techniques to utilize. For example, knowing the occupant's blood type will enable advanced procurement of blood if a transfusion is needed.

THE AUTHOR

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LET'S TALK

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