HELMET DETECTION BASED VEHICLE USING DEEP LEARNING

Code for Good : Hacking for a Better Tomorrow

Team Name: Team Spark

Theme: Human-Computer Interference

Team Members:

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- **Problem Statement:**

The problem we're addressing is the alarming surge in motorcycle-related fatalities stemming from non-compliance with helmet-wearing regulations in India. With approximately 150,000 deaths annually, translating to 47 accidents and 18 fatalities per hour, along with a shocking 1,130 accidents and 422 deaths daily, India grapples with a dire road safety challenge. Despite its expansive road network, ensuring individual safety remains a formidable hurdle. Despite many rules, where the user is made to pay a fine if found without a helmet, the user only wears it for the sake of avoiding such a fine.

To tackle this issue, our proposed solution leverages cutting-edge technology to enforce continuous helmet use during motorcycle journeys. We're developing a system that halts ignition until the rider wears a helmet. This innovation employs Deep Learning, specifically YOLOv5, and CNN, and integrates hardware for real-time rider monitoring using OpenCV and a microcontroller. We've set a bounding-box accuracy threshold of 75% and are actively enhancing it. This technology significantly bolsters road safety by promoting helmet compliance, offering real-time monitoring, and generating insights for informed decisions on road safety enhancements.

- **Human-Computer Interface (HCI):**

The proposed system uses Deep Learning and image processing, specifically OpenCV, YOLOv5, and CNN to monitor whether the user is wearing a helmet in real-time.

It integrates hardware to control the ignition access by controlling the keyhole of the vehicle, making it a clear example of how technology interfaces with human behavior for safety.

The system's ability to provide real-time alerts and monitoring also relates to HCI, as it involves user interaction with the vehicle's safety features.

- **Proposed Solution / Your Big Idea:**

To create a reliable system, a unit is developed where the user cannot start the ignition unless and until he/she wears a helmet. So, the proposed system continuously monitors the user in real-time and detects the user wearing a helmet, for which Deep Learning is used. Also, hardware is designed which will control the access of the keyhole of the vehicle. The vehicle ignition cannot be started unless and until the user wears a helmet and keeps the helmet on for the entire ride i.e. the keyhole access won't be granted unless the user is detected wearing a helmet. **The existing systems do not provide these features.** This is an independent unit which can be attached to any two-wheeler. To detect the user with a helmet, deep learning (CNN) is used where the dataset is trained using YOLOv5. The dataset is annotated on Roboflow. The user tends to deceive the system by wearing a helmet just for the sake of detection. However, the proposed system continuously monitors the user, hence he/she has to wear the helmet throughout the journey.

To prevent users from momentarily wearing a helmet for system activation, we've implemented a progressive speed reduction mechanism. If a rider removes the helmet mid-journey, the system provides a warning alerting the user to wear a helmet and despite ignoring such warning, the system gradually reduces the bike's speed until it comes to a complete stop, ensuring safety regulations are followed throughout the ride and minimizing the risk of fatal head injuries. Moreover, the system proves to be advantageous by restricting access to the keyhole of the vehicle. Society will largely benefit as this system ensures their complete safety.

Our innovation not only enhances road safety by encouraging helmet usage but also offers real-time monitoring capabilities, enabling immediate interventions and improving rule enforcement by traffic authorities. Additionally, it collects data on helmet usage patterns and vehicle movements, facilitating data-driven decision-making for road safety improvements through an enhanced Human-Computer Interface. Once integrated with smart infrastructure, our solution can contribute to solving broader traffic management challenges, making roads safer for all.

- **How does your innovation accelerate change with the power of Technology? :**

Our innovation leverages technology to transform road safety by addressing the critical issue of non-compliance with helmet regulations among motorcycle riders, creating a robust Human-Computer Interface. By employing Deep Learning, specifically YOLOv5, and image processing technology through OpenCV, we continuously monitor riders in real-time, ensuring helmet use before starting their journeys.

The innovation also incorporates a progressive speed reduction mechanism, a key aspect of Human-Computer Interaction. If the rider removes the helmet mid-journey, use technology to promote sustained helmet use.

Furthermore, our system offers real-time monitoring capabilities, which makes the system fool-proof. The user won't be able to continue the journey if he/she removes the helmet mid-journey. Thus, a warning will be provided to wear the helmet. This provides additional safety through the Human-Computer Interface.

- **How is your solution different/unique from other solutions in the market? :**

Our solution stands out from existing systems by combining Deep Learning and image processing (CNN, YOLOv5, and OpenCV) to continuously monitor helmet usage in real-time, enhancing the accuracy and reliability of helmet detection. This creates a more seamless Human-Computer Interface.

What sets us apart is our control over the keyhole of the vehicle. If the vehicle won't start in the first place if the user is without a helmet, the user won't be able to deceive the system. Along with that, a progressive speed reduction mechanism is implemented. If a rider removes the helmet mid-journey, our system gradually decreases the bike's speed until it stops, ensuring sustained helmet usage throughout the ride, a feature that actively involves the rider in a Human-Computer Interaction.

As existing systems majorly implement transmitter-receiver systems, where the vehicle is the receiver and the helmet is the transmitter. Unlike other systems that may be deceived by temporarily placing a helmet near the bike just for the sake of establishing a connection, our solution focuses on continuous monitoring, and the person along with the helmet is detected, making it much more robust in ensuring compliance with helmet regulations through Human-Computer Interaction.

Furthermore, our innovation collects data on helmet usage patterns and vehicle movements, enabling data-driven decision-making for road safety improvements, a process significantly influenced by Human-Computer Interaction. Additionally, once integrated with smart infrastructure, our system can contribute to comprehensive traffic management solutions, making it a unique and multifaceted approach to road safety with a strong Human-Computer Interface component.

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