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BikeGaurd - Project Proposal

Whether it's gas prices, traffic, carbon emissions, or health and wellness reasons, many individuals choose to get around on a bike. With that being said, around 80% of bike owners have been a victim of bike theft[1]. To address this issue, we propose a vehicle theft detection device that seamlessly attaches to bikes and alerts the owner of a potential theft attempt. Our device will use machine learning to classify audio[2] as either theft or non-theft related. The device will also be equipped with small cameras and proximity sensors to distinguish theft and non-theft events accurately. We will collect and train our model on various theft-related sounds such as hammering, lock picking, and metal cutting as well as non-theft-related sounds such as urban noises, accidental bumps, and rough weather. Furthermore, we can utilize noise reduction techniques[3] to filter out environmental noises to improve detection accuracy. Once our device identifies a bike theft attempt, it will send a notification via cellular SIM card to the user on an app on their phone so that they can take action to prevent the crime. Further implementations could include an awareness siren, a GPS tracker, and capabilities to alert police.

Our device will consist of a microcontroller, potentially a Raspberry Pi, a microphone, cameras, various sensors, a battery, a small LCD screen, and a lean

[1] https://www.axios.com/2023/07/20/car-thefts-2023-kia-hyundai-crime-data
[2]https://wandb.ai/mostafaibrahim17/ml-articles/reports/An-Introduction-to-Audio-Classification-with-Keras--Vmlldzo0MDQzNDUy
[3] https://www.soundguys.com/how-noise-cancelling-headphones-work-12380/

housing unit. Potential renditions could include a siren, a GPS tracker, and other hardware components.

We plan to break our project down into 5 steps: data collection and data analysis, model training, hardware integration, interface integration, and final deployment. During the data collection process, we will gather a large and varied dataset of both normal bike-riding sounds and theft-related sounds. Then we plan to feed our data into a balanced model for accuracy and efficiency (such as TinyML). After training our ML model, we will start integrating our ML part with hardware such as cameras and proximity sensors. Then, we hope to make a simple interface for customers to get notified of a potential theft event. The timeline of this project will most likely take a whole year. We will focus on ML model training for the first semester, and then hardware integration during the second semester.