The XDK Car Theft Alarm System

Low-Cost Protection for Older Vehicles

Introduction and Challenge

According to US government statistics, a vehicle is stolen in the U.S. about every 44 seconds. New car buyers have vehicles equipped with theft-deterrent mechanisms and effective alarm systems. However, there are still a lot of older vehicles on the roads. Although various aftermarket security systems are available which can be retrofitted into cars, many of these vehicles have little to no protection at all. The main reasons are that these systems are unreasonably expensive to buy and maintain.
A low-cost and reliable theft alarm system based on the XDK from Bosch promises to put an end to this situation. It is designed to use basic electronic components and has very low power consumption. Nevertheless, it works just as well as the more expensive systems on the market.

Approach

The Internet of Things (IoT) is revolutionizing every area of our daily lives, and Bosch Connected Devices and Solutions (BCDS) is playing a leading role in developing innovative devices and solutions for it. BCDS introduced the XDK in 2016: the Cross Domain Development Kit, or XDK for short, packs a powerful combination of hardware and software into a tiny package. An accelerometer, gyroscope, heat and light sensors and more, all packed into about the size of a tin of mints. The device uses multiple microelectromechanical systems (MEMS) sensors from Bosch to bring digital awareness to new consumer products. The XDK is designed to simplify IoT prototyping and to support users in developing their own new product ideas.

The XDK-based car theft alarm uses the accelerometer and microcontroller of the XDK.

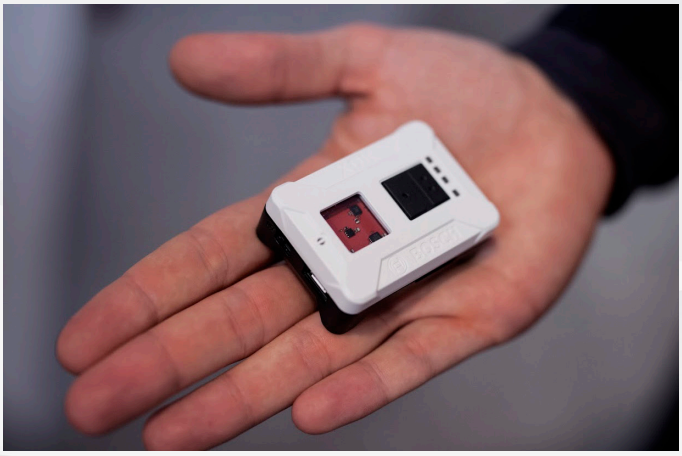
Use Case
The XDK car theft alarm was developed by Robert Bosch Engineering and Business Solutions Ltd., a 100 percent owned subsidiary of Robert Bosch GmbH in India. An Innovation Team initiated the project.

The system detects car theft based on acceleration change. The XDK accelerometer provides the acceleration values that the car is experiencing. Once the driver has left the car and activated the theft alarm system, the accelerometer monitors the vibration/ acceleration across the car and feeds it to the algorithm. If there is any deviation from the expected behavior, the algorithm notifies the driver of a theft scenario.

To be able to detect deviations, an acceleration profile is generated. It serves as a standard reference. Whenever the algorithm detects an acceleration change, it compares the value against this reference profile to determine whether it is an actual theft scenario or not. If the acceleration is above a particular threshold for more than a certain amount of time, the system sets off an alarm by notifying the driver via text message through a GSM module. The driver is also notified if the car's position changes by more than a certain amount, not just through acceleration.

To avoid false alarms, debouncer logic is used. It makes the system more robust. The software collects the accelerometer data from the XDK in real time and processes it based on the type of acceleration profiles, i.e. static and dynamic acceleration. Sensor noise is eliminated through the use of sophisticated filters. The filtered data is passed through several tests to prevent false alarms. If the sensors detect too many changes in acceleration or if it accelerates for too long, the alarm sounds.

The alarm system is activated only when the driver has left the car, which reduces the



overall power consumption. The polling for a theft scenario is carried out by the software every "x" milliseconds (this parameter is configurable) and not continuously. This reduces the power consumption even more. Once the activity is detected, the system is fully awake and the described software algorithm checks the validity of the scenario.

The Role of Bosch Connected Devices and Solutions
As an innovative company, Bosch Connected Devices and Solutions (BCDS) can draw on extensive experience in sensors and software solutions. By combining our expertise with partners from different business entities such as Bosch Sensortec and Akustica, we can enable new value proposals and new ways of creating value.

XDK from Bosch is a prototyping platform for any imaginable IoT use case. With its multiple MEMS sensors, the XDK enables time and cost effective realization of IoT applications. The system architecture for the car theft alarm is built on the XDK. The kit provides a common platform with an inbuilt accelerometer and microcontroller that made prototyping for this project fast and easy.

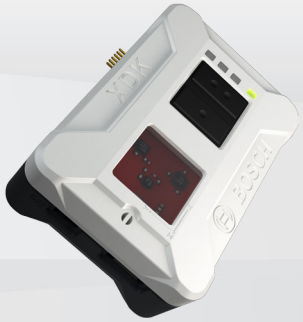
Solutions and Benefits

Regardless of advancements in vehicle security systems and an increase in their affordability, there are still a staggering amount of older vehicles on the roads that have no car-theft protection mechanism at all. These cars are often easy pickings for thieves who want to make some quick cash at the local chop shop. In contrast to wheel locks, ultrasonic sensors or other high-tech systems, the XDK-based car theft alarm system is affordable, and hence suitable for low-price cars. It will offer a solution for many car owners who otherwise couldn't afford any alarm system. The XDK car theft alarm uses only one of the eight sensors of the XDK kit, the accelerometer, and the included microcontroller. Based on one of the most fundamental laws of physics, the law of gravity, the RBEI Innovation Team developed a solution that is much cheaper and consumes less power than the current alarm systems on the market, but is equally reliable.

Conclusion

The use case shows how the XDK can serve as a basis platform for many sensor-based IoT projects – from prototype to serial production. Due to its housing with included battery in a small form factor, it can be retrofitted to objects of any size. The XDK was designed with the user in mind and is simple to use. It can save money in development and also the use of the solutions built on it. The XDK-based car theft alarm is an example for a cheap solution that has been developed fast and easily and clearly provides more benefit to its users than competing products.

The case demonstrates how the XDK can accelerate prototype building for IoT projects – with less compromise, less loss of time, more freedom in development, and an easy path to scale production.



About Bosch Connected Devices and Solutions

Bosch Connected Devices and Solutions GmbH is based in Reutlingen, Germany and is a 100% owned subsidiary of Robert Bosch GmbH. As an innovative company, it serves the new market for the Internet of Things. We offer compact electronic devices, comprehensive software and end-to-end solutions in many fields of application. Our main businesses are in the areas of Connected Mobility and Industry 4.0 and Logistics. We improve everyday life, increase comfort, security and productivity.

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