

FRAUNHOFER INSTITUTE FOR MICROELECTRONIC CIRCUITS AND SYSTEMS IMS



1 Typical bicycle accident

## CAMBER-RECOGNIZING BICYCLE

### Safety often gets the short end of the stick

There are over 70 million bicycles in German households. Even if only every second bike would cycle a short distance of five kilometers around the block, the distances traveled would surpass the distance between earth and sun by far.

Nearly every third person uses their bike several times a week as transport vehicle and at least as many plan on using their bike more often in the future. That is the insight of a survey about bicycle user behavior conducted by the federal government. The bicycle mainly gets used for shopping, brief transactions and excursions; roundabout a third of the users travels to work or educational institutions on their bike.

But safety does not always accompany them. Although the number of cyclists wearing a helmet is slightly increasing, it is only every seventh cyclist to do so. Furthermore, many cyclists do not care sufficiently about illumination, even though half the cyclists

do not feel safe participating in traffic with their bikes. This behavior can become dangerous: In 2014, the number of bicycle accidents increased by almost ten percent!

### Quick first aid

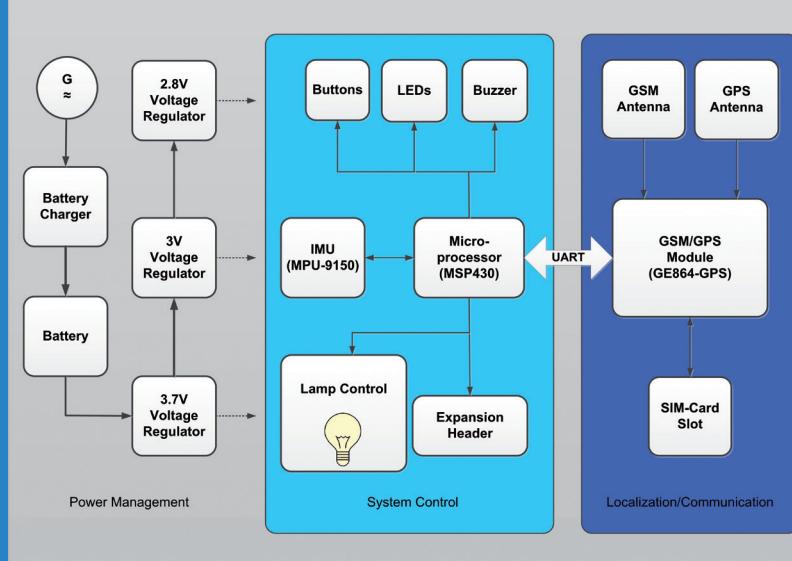
The Fraunhofer IMS has developed electronics for bicycles, which recognize camber of the cyclist and send the GPS-data of the accident site to a filed phone number. This technology can be integrated into a bicycle lamp or a tachometer. That way, the electronics ensure a quick first aid and help severely injured people to be treated quickly. The electronics operate energy self-sufficiently and can be operated in a range of temperature, which smartphone solutions fail to. Because of its variable fitting possibilities, it can be applied to different types of bicycles.

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### Geolocation after bicycle theft

Not only after an accident can the electronics call for help, but also a theft alert is possible due to this sensor solution.

Officially, on average 930 bikes got stolen daily in 2014. With a clearance rate of ten percent, it is fairly unlikely to get your bike back. In this case, the electronics developed by Fraunhofer can help. A text message gets sent to the bicycle, which in response will send the current location of the bike.

Localization of children and elderly, which are underway on their bike, is also possible.

### New features for tachometer and lamp

These assistance systems can even be applied to the fitness area, by adding additional sensors to the electronics.

For example, a chest strap for monitoring and measuring the heart rate is possible. For a joint-protective and targeted workout, the number of crank revolutions per minute is an important measured parameter, which can also be captured by sensors. Measured parameters such as pace, average speed, distance completed incl. information about the completed height profile can also be captured by respective sensors which are fitted to the wheels or via the GPS-module.

### Forecast

Currently, electric supply is ensured by the bike's dynamo and a Li-Ion battery but solar-powered energy supply, depending on the utilized sensors and adjustments to the installation situation, is possible.

Also possible - but associated with further development effort - is the automatic theft recognition of individual parts, which often occurs when the bicycle has been locked securely.

The resulting data is not only of use to the bike owner but also a bicycle rent agent, which by evaluating the data can optimize their business model and processes.

### Applications

#### Emergency function

- Automatic camber-recognition
- Emergency call with location

#### Theft protection

- Automatic theft report
- Geolocation after theft

#### Tachometer / Fitness

- Pace measurement
- Distance and time measurement
- Tracking of the training route
- Tracking of the heart rate
- Tracking of the pedaling cadence
- Tracking of the height profile

### Technical Features

- Energy supply by dynamo
- Rechargeable batteries (Li-Ion)
- Wireless data transfer (GPRS)
- Digital voice interface optional (GSM)
- GPS-module for geolocation
- Sensors (MEMS)
  - Rotary movement
  - Acceleration
  - Compass
- Control of the bicycle lamp (visual distress signal – SOS)
- Optional sensor interface

### IMS Services

- Consulting
- Feasibility studies
- Conceptualization
- System development
- Hardware-Design
- Software-Design
- Prototyping
- CE-Consulting