

# System for voice control of car modules with communication through CAN network

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**Abstract:** A system for development, installation and practical testing of control of car electronic modules through voice commands is presented. The system is capable of having configuration for different car models with different CAN network specifications. There is an intuitive and easy to use user interface with flexible navigation. The system is presented and defended as bachelor's thesis in Technical University – Sofia, in Faculty of Computer Systems and Technologies in 2010.

**Key words:** voice commands, voice control, cars, automobiles, CAN network, software,

## 1. INTRODUCTION

The modern automobiles come with lots of electronic components and features. Usually they are connected through a CAN bus [2]. The idea of using voice control of such electronic components is not new – it has a long history of examples in the scientific fiction movies. Until now only the high-end models of automobiles are introducing real voice control applications; however most of them are limited to multimedia and fun use only and do not control essential components of the car. With the presented system we will show how the voice control has much wider application in cars.

## 2. VOICE CONTROL USAGE IN CARS

The voice control is a very flexible for control of devices; however not enough “trusted” way to control computer components. Different background noises or change in the human mood may disrupt the voice recognition making it impossible for the computer to parse the command. Therefore a very careful examination on what components of the car exactly can be controlled with voice must be made. In [1] the following comparison between human and computer skills is presented:

- Work in unexpected situations: the human is very good and the computer is usually helpless;
- Usage of different non-standard methods for doing specific tasks: the human adapts well using creativity while the computer is always functioning through fixed algorithms;
- Problem solving: the human can work and solve unknown problems while the computer is always solving only known problems;
- Computing: the human has limited possibilities in comparison to the computer;
- Complicated calculations: the human is much slower in making complicated calculation tasks in comparison to the computer.

Since driving is a complicated task with lots of unknown and unpredictable situations, we must conclude that the voice control system must focus only to features which are not critical for the human safety. Therefore we are still technologically limited only to the features which will not put the driver at risk. The presented system [4] is currently limited to the following tasks:

- Multimedia control;
- Mirrors adjustment;
- Opening and closing windows;
- Trunk control on stopped car;
- Seat adjustments;
- Locking and unlocking doors;
- Date and time voice indication;
- Additional functions according to the car model.

As additional features the “moving mirrors down in reverse gear”, “high speed alert” (must be connected with GPS receiver for effective usage) and “alert for improperly closed door(s)” are additionally enabled. Every voice controlled feature is of course duplicated with physical control version so the devices in the car are not limited to “voice controlled only”. This gives alternative backup way to control the devices in case of voice recognition failure. The mentioned features provide a flexible “hands free” way to control the electronic devices and bring much more safety for the driver because he do not lose focus from his main target – the actual driving.

## 3. HARDWARE INSTALLATION AND USAGE

The required hardware for installation of the system is a portable computer (it is recommended to have uninterrupted power supply from the car cigarette lighter), a microphone, a voice control button, a CAN network cable and a CANUSB adapter. The microphone and the button must be located in suitable position, specific for the car model (Fig. 1).

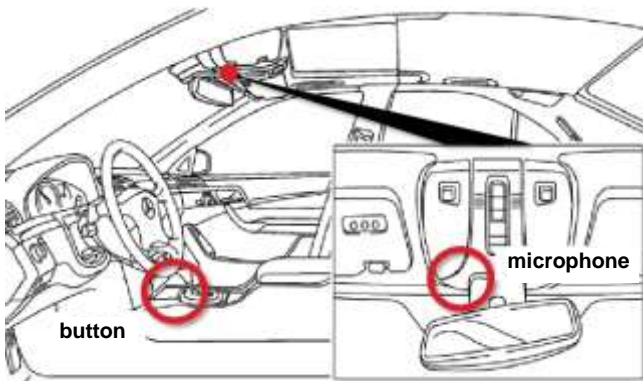


Fig. 1: Position of microphone and button

When the button is pressed the voice recognition engine on the portable computer starts. The driver instructs the computer with specific predefined commands. The computer replies with confirmed or denied (unrecognized) message in exchange. If the command is recognized, then the computer sends a signal through the CAN network to the device which must be adjusted (seats, mirrors, etc).

The principle of moving right window up or down is presented on the graph on Fig. 2.

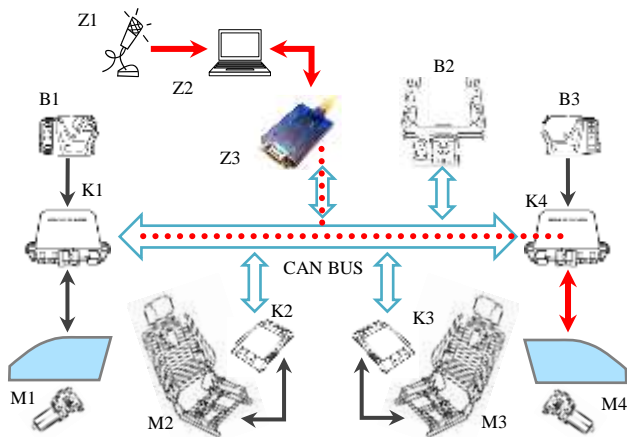


Fig2: Z1: microphone; Z2: computer; Z3: CANUSB Adapter; K4: right door control module; M4: right window actuator.

#### 4. CAR VOICE COMMANDS SOFTWARE

The software is separated with user and administrative interface. In the presented implementation the software is written for Microsoft Windows; however alternatives with Linux or other OS can be made with adaption of third-party voice recognition engine. The user interface is simple and easy to use even on small portable computers with touchscreen (Fig. 3).



Fig. 3. User interface

The "Load Commands" button is giving an option to load the preferences file. That way the computer can be moved from one car to another and load the car-specific voice commands only. The "Start/Stop Recognition" button can be pressed through the portable computer or (preferably) distant using the hardware button. The "Open Connection" option is used to establish communication with the CAN network. All these functions can be started automatically for the user's convenience.

For the user interface there is an additional extension which enables the user to see more details from the CAN bus such as mirrors and seats positions, current speed and engine status. There is an option to enable/disable special features (Fig. 4).



Fig. 4: Special features in the user interface

The administrative interface provides options for adding, deleting and editing voice commands from the configuration files (Fig. 5).

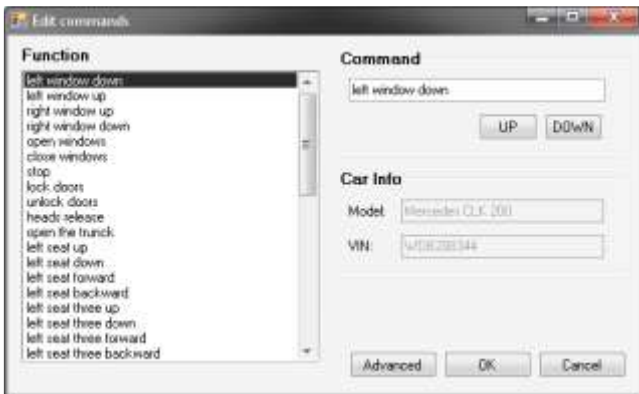


Fig. 5. Administrative interface

The “Advanced” mode in the administrative panel provides also an option to add completely new car features which are not yet recognized and completely new for the software (Fig. 6).

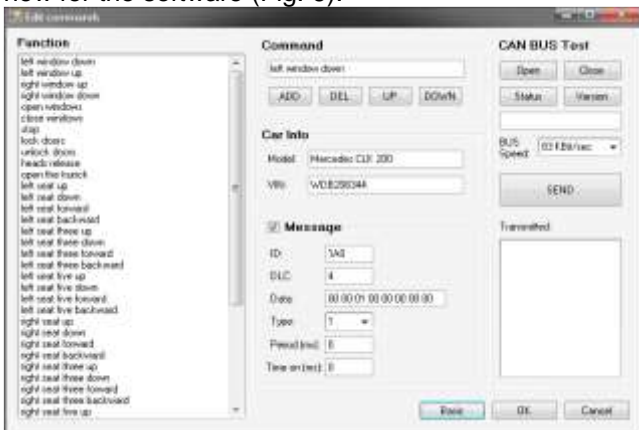


Fig. 6. Advanced mode of the administrative interface

Using the advanced mode the software will be “sniffing” the current CAN network traffic and that way new features can be recorded and voice commands added accordingly. This makes the software extremely well portable between different car models. Also every voice command for a specified function is customizable and can be changed according to the user taste and preferences (ex. “left window down” can be replaced with “open left window” etc.).

## 5. REAL LIFE TESTING AND CONCLUSION

A fully functional system was installed on Mercedes CLK 200 – a car without any stock voice recognition capabilities. All our tests show that the voice commands of car devices is a flexible and comfortable feature which may bring the “hands free” driving at further level. Example installation is presented on Fig. 7.



Fig. 7. Example installation

The programming language that was used for the example software implementation is C# in .Net environment [3]. In near future open source multi-platform software is intended to start development.

## REFERENCES:

- [1] Jordan Kuichinov, Ivan Gantchev, Methodical insurance of the teaching in mathematics and the usage of personal computers – necessity possibilities and status, Teaching of Mathematics 4 – 1986, Narodna Prosveta.
- [2] St. N. Djiev, Industrial networks for communication and control, Technical University – Sofia publishing, 2003, pages from 66 to 72.
- [3] Stoian Yordanov, Programming for .Net platform, BARS, 2004
- [4] Dimityr Stoimenov, System for voice control of car modules with communication through CAN network. Bachelor's thesis in Technical University – Sofia, 2010

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