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Automated Profile Vehicle Using GSM Modem, GPS and Media Processor DM642

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Abstract. This paper discusses the implementation of the embedded system design to control automobile peripherals automatically through voice recognition system. Authorize user profile will be stored in the system which carries specific settings for the user. When the user wishes to drive the car, system will activate the personal settings by recognizing the user's voice which includes setting of the side and rear mirrors and seat adjustments. The real time snapshot of the driver is also taken using DM642 media processor and displayed on the LCD screen with available profile information. The smart car can also be remotely locked or unlocked using GSM modem. Another feature of navigation and tracking of car using GPS module is also included in the system. The system takes latitude and longitude positions from GPS and sends to the PC using GSM modem. The real time location of the car is further displayed on the map on PC.

Keywords: Embedded Systems, Voice Recognition Systems, GPS, GSM Modem, Media Processor.

1. Introduction

Smart objects are small computers with a sensor or actuator and a communication device, embedded in objects such as car engines, light switches and industry machinery [1]. Smart objects enable a wide range of applications in areas such as home automation, building automation, factory monitoring, smart cities, structural health management systems, smart grid and energy management, and transportation [1]. Smart things can explore their environment, communicate with others smart things and interact with humans therefore helping users to cope with their tasks in new and intuitive ways [2].

Smart embedded systems are very interesting and rapidly growing areas in recent days. Many organizations are working on different daily routine applications to make them intelligent like smart homes and smart phones.

In this current era the vehicle security is a big issue. Although different safety measures are taken like GPS tracking systems, remote based car locking system, safety switches and other systems. Also the vehicle navigation is quite significant especially for vehicle tracking. All these advancements have been done to facilitate the humans in the environment. In this way many smart systems are researched and developed to reduce the human effort and increase the system reliability and security through various state of the art technologies. That is why we decided to enhance these systems by reducing human interaction with machine directly.

These days people use LCD screens in cars for watching DVD and use remote control for car security. Keeping these in mind, the smart system is developed which uses video interfaces for graphic display, human profile display and GPS navigation system on remote server, real time image capturing of the driver through media processor DM642 and CCD camera and then displays the snapshot of user with all of his profile settings on LCD Screen. Beside all these things, the peripherals (rear and side mirror with seat adjustment) in the smart car are also controlled automatically using speech recognition systems.

This paper discusses the implementation of such smart systems in a normal car which makes it intelligent. This embedded system is based on PIC 18F877 micro-controller which is the main part of the system and controls all of the system operations. The work has been done to design the system to memorize the

customize settings of seat adjustment, side view mirror and rare view mirror automatically using voice recognition for the authorized driver. The authorized driver will store all of his customize settings of rear, side mirrors and seat adjustment using his secret word. Whenever the driver sits in the car again he will say the secret word again and the system restores all of his settings automatically. For speech recognition system, HM2007 IC is used to store and recognize the speech. It is also interfaced with the micro-controller. If the user is authorized through his speech then micro-controller initiates the user settings.

The status of car door locks can also be checked through Short Message Services (SMS) using GSM modem. The authorized user sends particular SMS to the GSM modem in the car and it will reply the current status of car locks. The authorize driver can also lock or unlock the car remotely by sending SMS to the GSM modem connected with the car.

The system has an advance feature of GPS, which provides navigation and tracking of the car. It gives the position of latitude and longitude to the micro-controller. The micro-controller further sends these values to the user PC using GSM modem. The GSM modem sends the SMS messages regularly to the mobile connected with the PC for navigation. The exact location of the car is also plotted on the map.

The LCD screen is also used to display the current snapshot taken by the camera with the user profile. For this purpose DM642 media processor kit is used.

The rest of the paper is organized as follows: section 2 will present the overall system model. Section 3 will discuss the working of the system. Section 4 briefly discusses the software used in the work. Section 5 presents the discussions and results and finally section 6 will end the paper with conclusion and future work.

2. System Model

The system consists of six main parts. The main micro-controller based embedded system, media processor DM642 based system, voice recognition system, car profile adjustment system, car navigation system using GPS and remote monitoring and control system. The overall block diagram of the system is given below.

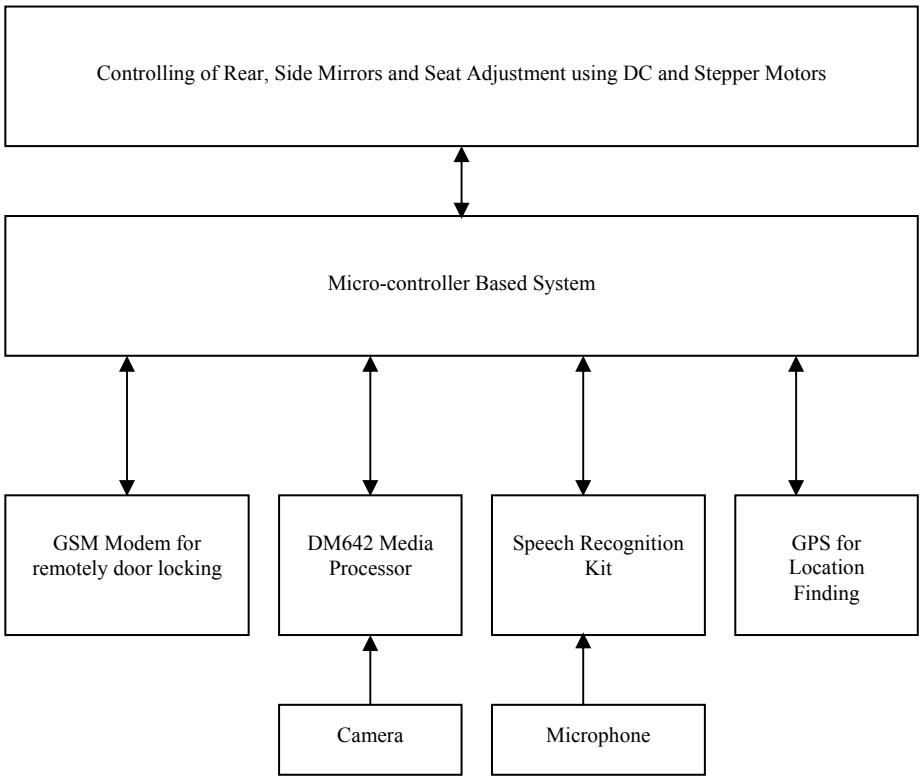

Fig. 1: Overall Block Diagram of the System.

2.1. Micro-controller based Embedded System

The micro-controller based embedded system is the central unit which controls all of the operations. It connects directly to the GSM based actuator Control and Voice Command Based Control. It also provides

five key interfaces. The key interfaces used in the system are Media Processor Interface, Voice Recognition Interface, Interface of the GSM module, GPS Receiver Interface and Car Adjustment Interface.

2.2. DM642 Based Media Processor System

The Media Processing Interface is one of the key features of this work. The DM642 is the highest-performance fixed-point DSP in the TMS320C6000 DSP platform [3]. It comes with the full compliment of onboard device that suits wide variety of application related to video processing. DM642 media processor in the kit is responsible for on board video acquisition, processing and display. This architect is based on the Real Time Operating System (RTOS). Media processor card comes with the built in camera through RTOS it acquires video and processing and binding information displays it on attach LCD.

The CCD camera is connected with the system which is interfaced with the DM642 media processor. It is also responsible for displaying scanning profile message, capturing image from CCD camera and to display image with profile data on LCD screen. It processes the information and matches it with the existing user and if the user is a authorized driver, then displayed its profile with his current snapshot.

2.3. Speech Recognition Kit (SRK-07) and HM2007

The Speech Recognition Interface is designed to control the car peripherals i.e. rear mirror, front mirror and seat adjustments for particular users. The heart of the circuit is the HM2007 speech recognition IC. The IC can recognize 40 words [4]. Firstly, the user enters into the car and says a specific word which will be used to recall his settings. The SRK-07 speech recognition kit is used to recognize the word and recall the user settings of the mirrors and seat adjustments. If it matches the word already stored in the system, the system will initiate the saved settings for that user. The mirrors and seat will be adjusted using micro-controller and the profile of the user will be displayed on the LCD.

The microphone is attached with the speech recognition kit (SRK-07). Before any voice recognition, the system must need to be trained. This is done by keypad interfaced with the micro-controller and the SRK-07 kit. Firstly, the voice of the user is stored on particular memory location and when the kit recognizes any word it displays the same location on the attached seven-segment display. If it does not recognize the speech 77 will be displayed on seven-segment which shows speech is not recognized.

2.4. Car Profile Adjustment System

The specific settings of seat and mirrors for the authorize driver is controlled by micro-controller. The seat adjustment is done through the DC Geared Motor connected with the seat whose position is found through the potentiometer reading attached to the seat. In such adjustment micro-controller starts the motor and acquires the required position through potentiometer and when the position in the form of voltage is achieved, it just stops the motor at particular position.

The mirror adjustment is achieved through 2-two phase stepper motor with 1.8 Degree step size. For mirror adjustment microcontroller provides the particular stepping pattern to the stepper motor in order to attain particular degrees.

2.5. Remote Monitoring and Controlling of Car Locks

The GSM Module interface is responsible for controlling and monitoring of car locks through Short Message Service (SMS). It is a service provided by mobile operator by which user can send a limited text message to other mobile phone. The GSM modem is interfaced with micro-controller and when the specific SMS message is sent, the micro-controller replies the current car lock situations and it can also be changed by another SMS message. The communication is done using AT command set. Only authorize users can monitor or control the status of car lock.

2.6. Car Navigation System using GPS

The GPS Receiver Interface is also used to acquire longitude and latitude positions from GPS Receiver through NMEA Protocol Standards which is used to locate the car on the map. The Garmin-Etrex GPS receiver is used, which is connected with the serial port of the micro-controller.

3. Working of the System

The system is real time distributed embedded system, which controls many parameters of the car and make them intelligent. This smart system is integrated on the designed model car. The authorized user operates the car through his voice. The user can also monitor or control the status of door locks via remote location using his mobile phone. The authorize user can also stores many driving settings of his choice like position of a side view mirror, rare view mirror and seat adjustments. All these parameters of smart system is controlled by the PIC18F877 microcontroller which is the heart of the system.

System is also able to send alert messages in case of security breach. GSM modem is used for this purpose which allows to send and receive text messages using AT command set. This is a specific command set used to interface GSM modem or mobile phone with the embedded system or computer. Its text mode is selected and AT+CMGS command is used to send SMS using micro-controller [5].

The messages of locking and unlocking of car door locks can be sent through SMS. The status of the door locks can also be sensed using GSM modem. For this purpose, the user sends a particular SMS message to the GSM modem in the car which is processed by the micro-controller and generates the SMS reply with its current status. The authorized users can use this service.

Speech recognizing feature is very important part of this work, when authorize driver sits in the car and say a specific command word through microphone, speech recognition kit SRK-07 starts processing the voice of the driver using HM2007 IC and if the user is authorized, it takes its current picture of the driver using CCD camera and displays it on the interfaced LCD screen with all of its profile details. For authorized users, the predefined user settings of rear and side mirrors with seat adjustments will also be adjusted automatically. These parameters are adjusted by using DC motors interfaced with the seat and stepper motor connected with the mirrors. If the person is authorized, the SRK-07 kit sends the confirmation signal to the micro-controller and it operated the motors and performs the desired tasks. At the same time micro-controller also sends signal to the DM642 media processor to take current snapshot of the user. The media processor is interfaced with the LCD screen which shows the real time current picture of the user. This task is working as slave with micro-controller. Finally GPS interface provides navigation and tracking of the car on map. The GPS sends the latitude and longitude values to micro-controller serially. These values are further transmitted to the user through GSM modem which is also interfaced with the micro-controller.

4. Software used in the work

There are three different types of software used in the work. The first one is for micro-controller programming. PICCW software is used to write the code for micro-controller programming. The programming of the micro-controller is done in C language. The second software used is for GSM modem. The AT command set is used for this purpose. Its text mode is used. The locking and unlocking of the car doors is controlled through GSM modem using AT commands. The location finding is also done through this command set and a series of SMS messages are sent to the remote mobile which provides the current location and tracking of the car on PC.

The Code Composer Studio 3.1 is used for media processor DM642 programming. The programming is done to display the information of the user with his profile and real time snapshot on the LCD screen.

The speech recognition kit comes with the built-in firmware. The secret words of the users are stored first using microphone connected with the SRK-07 kit using keypad. The output of the kit is connected with the micro-controller to process the information and makes the decision of authorizing the person.

5. Discussion and Results

Firstly, the user will store his secret word in the memory of HM2007 using speech recognition kit SRK-07. The user's settings of the rear and side mirrors with seat adjustment is stored in the micro-controller's memory. The system starts working when the user comes again and say his secret word, the SRK-07 kit recognizes the speech and if the user is validated it sends the authorization signal to micro-controller which further recalls his profile setting and adjust the peripherals of the car automatically according to the specific user. The snapshot of the hardware including LCD screen and media processor is given below.

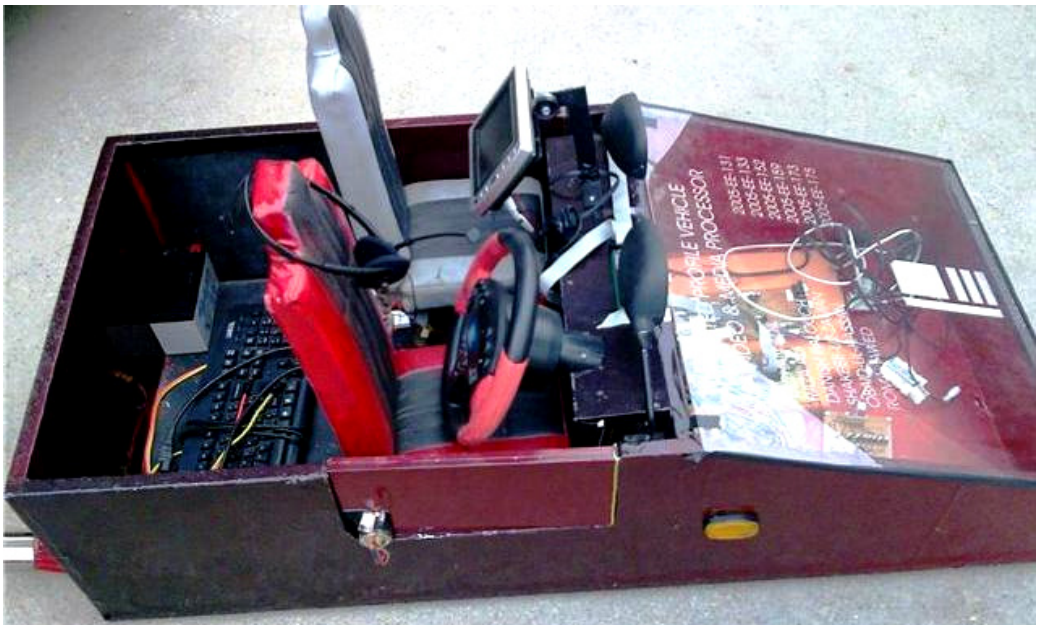

Fig. 2: Snapshot of the smart car

6. Conclusion and Future Work

The model car is designed which integrates many advance features. One of the features is user authorization using speech recognition. For authorize users, the settings of the car like rear and side mirrors and seat adjustment is done automatically. The real time snapshot of the authorized driver is also displayed on the LCD using DM642 media processor. The complete system is controlled by PIC18F877 micro-controller which is the main controlling unit in the system. For car tracking, the Garmin GPS is also used which sends the current location of the car through SMS using GSM modem connected with the micro-controller. The authorized user can also monitor and control the status of car locks through SMS. The specific command word is sent to the GSM modem for checking and controlling the car locks.

For future enhancements in the system, video calling can also be provided using the media processor and mobile connectivity using WIMEX technology. Media processor can also be used to provide IPTV if it is connected to internet so the user can monitor his car. In future air-conditioning system can also be connected to smart system so user can start the car and heating and cooling system according to weather in advance so environment will become pleasant before driver used it.

7. References

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