

Automated Wireless Carpooling System for an Eco-Friendly Travel

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Experimental Results, Future Work, Conclusion and References.

Abstract - In this paper we discuss about the Design of an Automated Wireless Carpooling System (AWCS), which can curtail the over usage of on road vehicles to a considerable amount. This system is designed for private vehicle owners who commute individually from the workplace to home. The system makes use of pre registration method, by which only identified people get into the carpool vehicles so that crime can be reduced. The Central Monitoring system (CMS) used here intelligently handles carpool requests and switches them efficiently. The user can acquire details of his/her travel by sending a SMS from their mobile phone. Waiting centers are allocated at each part of the city and the users can enter the carpooled vehicles only from these waiting centers. A person is assigned at each waiting center to check the identity of the people entering. Thus the proposed AWCS can be implemented in a city efficiently.

Keywords—carpooling, pre-registration, CMS, waiting center

I. INTRODUCTION

We all know that vehicles produce several types of air pollutants. For humans, the most harmful are carbon monoxide, hydrocarbons, particulate matter, lead, nitrogen oxide etc. Hydrocarbons and nitrogen oxide combine to form smog which is very harmful. Particulate matter is harmful to human lungs. Carbon monoxide is mainly formed due to the partial combustion of automobile fuels. It also blocks oxygen's circulation in the body, a serious risk for the very young and very old. More than half of the cancers traced to air pollution are caused by a car's hazardous pollutants as shown in [6]. In the atmosphere, substances like carbon dioxide, produced from the burning of gasoline in a car's engine, contribute greatly to the greenhouse effect and debilitating climate change. These problems cannot be completely eliminated, but can be definitely reduced to a considerable amount if we use these resources in a conservable manner. The best way to conserve these resources is by reducing the number of on road vehicles. This can be put into practice by efficient way of Carpooling as shown in [7]. Carpooling reduces the costs involved in car travel by sharing journey expenses such as fuel, tolls, and car rental between the people travelling. It is one of the best ways to reduce the traffic on the roads, pollution and the need for parking spaces. It can also be described as the most efficient way to achieve sustainable growth with less environmental pollution. The rest of the paper is divided as follows- Motivation, Problem Definition, Related Works, System description,

II. MOTIVATION

Fig.1 shows the pie chart which denotes the various factors which contribute to air pollution. From the chart it is seen that 32.7% is from On-Road mobile sources which is the majority.

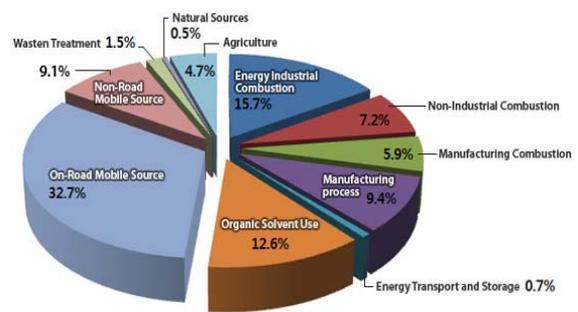


Figure 1. Pie chart showing the various factors contributing to air pollution [8]

These statistics made us think of a technique by which the on road vehicles can be reduced, without affecting the day to day lives of the people. This resulted in the design of Automated Wireless Carpooling System, which is proposed in this paper.

III. PROBLEM DEFINITION

Fig.2 shows the pie chart denoting how the atmospheric air is polluted due to On-Road vehicles. It can be seen that 58% is from fossil fuels which is the majority. So if we can curtail this, then it would have a great effect in playing a crucial role in molding up our sustainable, eco friendly and green earth.

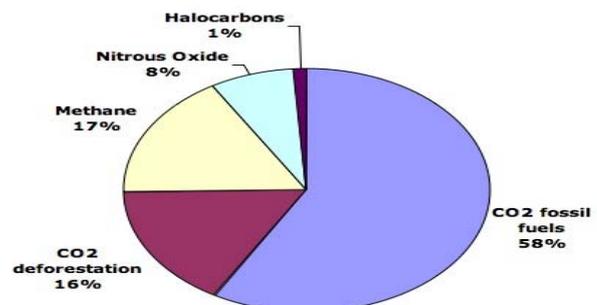


Figure 2. Pie chart showing how atmospheric air is being polluted due to road vehicles [9]

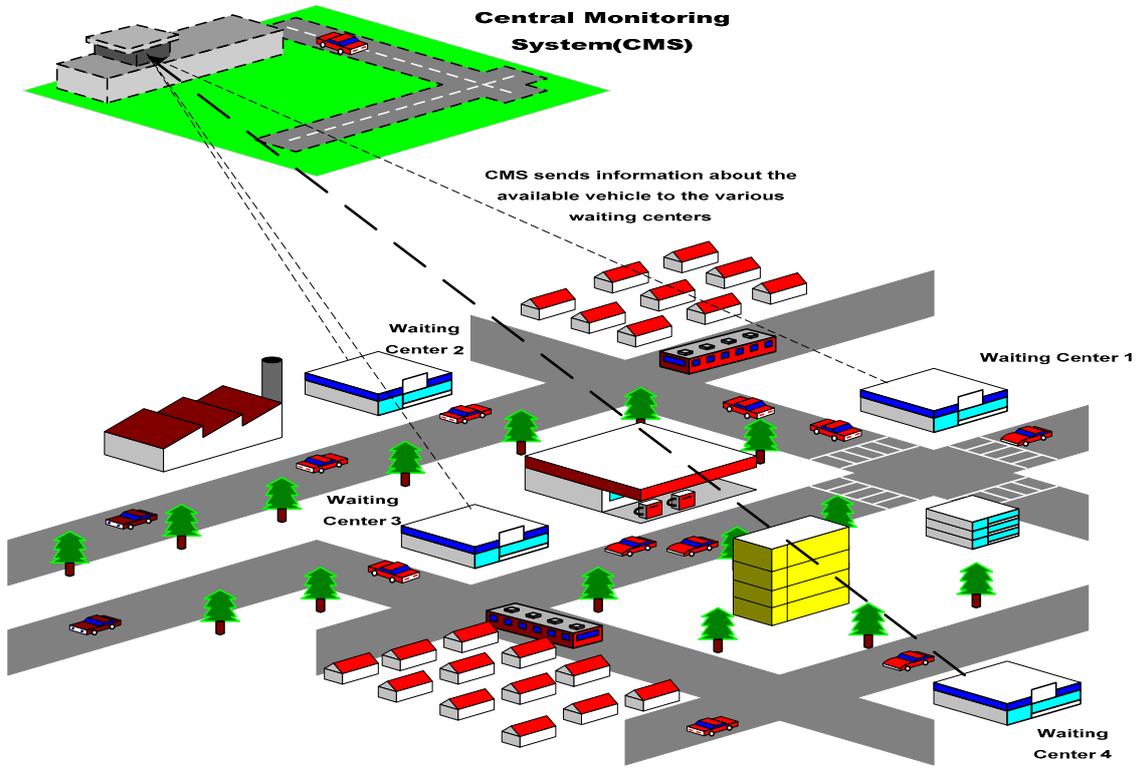


Figure 3. Overview of AWCS

IV. RELATED WORKS

Ref. [1] discusses about a positioning system which can be used to support a dynamic network of car. It says that the ride off request and acceptance is monitored through a common network. Ref. [2] discusses about a survey conducted among a group of faculty who commute a significant distance from home to workplace in Strasbourg, France. The survey proves how effective carpooling can bring if properly implemented. Ref. [3] discusses on aggregating multiple carpool requests into a single message and handling them efficiently. They make use of nodes for this purpose. Ref. [4] proposes a system which finds matching rides automatically every time when there is a new request from anyone. But none of the papers discusses about the security and safety that passengers receive from Carpooling systems. The design proposed by us takes this into consideration and makes sure that only identified people get into the cars so that crimes can be reduced to a considerable amount.

V. AWCS DESCRIPTION

In this paper, we suggest an intelligent system for carpooling which is very eco friendly. The AWCS which can be implemented in cities all over the world makes use of the wireless mobile technology. This system works with the help of Central Monitoring System (CMS) to share the

vehicles among passengers for travel thereby reducing the number of vehicles on the roads. This will reduce environmental pollution to a great extent. The usage of fuels will also be reduced thereby making the system environmental friendly. The various modules involved in our design are as follows:

A. Central Monitoring System (CMS)

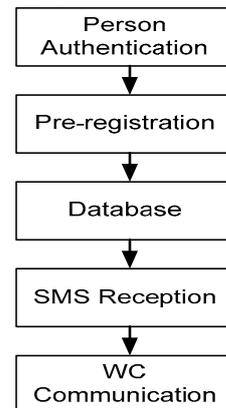


Figure 4. Block Diagram of CMS

To mitigate the problem of ever increasing air pollution due to on road vehicles, we have come up with a better

solution that could curb a large proportion of the emission due to on road vehicles as shown in Fig. 3. We have come up with a better version of carpooling in which we make use of a CMS, which could act as a controlling centre for the automobile density in a city during the peak hours of the day. This system basically focuses on the office-goers who possess private vehicles, because they are ones who contribute for the major share of automobile emission during the peak hours. Here all the office-goers who possess private vehicles can register with the CMS, providing the basic information about themselves. Thus all the details about the registered people are stored in the CMS database. During the registration, each person is given directions from the CMS on which day he/she is intended to provide with vehicle facility. In the system we also propose the idea of waiting centers to be located in major sections of the city which could accommodate people waiting for the car. The idea of Waiting Center was introduced to avoid case of crime. The person waiting for the vehicle has to show his identifications to the person at the Waiting Center. This can curtail the cases of theft and robbery caused nowadays.

B. Routing by CMS

When each person who has registered with the CMS gets out of his/her residence area, they send a SMS to the CMS informing their route and the destination. Thus the CMS sends the details about the person to the waiting centers in the respective route, so that the people in the waiting centers could board the respective car for their journey. This ensures safety of the people who have registered with the CMS.

C. Registering with the CMS

In order to register with the Central Monitoring System the office-goers have to provide their Office Identity so that all the office details of the person can be fed into the CMS database. Apart from this we prefer driving license as the photo and address proof, because apart from providing the basic information like photo and address the driving license can provide details on the mannerism of his/her driving. The driving license issued by the Motor Vehicle Authority of India contains three circles which indicate the person's driving history. Any past accidents due to his/her negligence are indicated with a black mark on any of these circles. Thus to ensure the safety of the Co-passengers the CMS doesn't allow person with a black mark on his driving ID to register with the CMS.

D. SMS and Voice Call Gateway

A GPRS modem is used at the CMS to SMS or place a call to the waiting centers or to its registered customers. The wireless mobile technology is used here to serve this purpose.

E. Case study of Amritapuri Campus Carpool System

The carpooling system proposed here has been partially implemented at the Amrita University, Amritapuri Campus. The carpooling system at present mainly focuses on the staff of the University. Here the person who avails the service of the carpooling system has to show his staff ID for authorization. Then the person has to fill in his personal details, his destination and the date and time of his departure in the registration form. Thus the carpooling management authority updates his details and checks for the details of other persons requesting for the carpool on the same date, if any. If they seem to match, all the requested people are informed of the same and asked to travel together to their common destination. Thus the number of cars travelling to a common destination is significantly reduced, thus curtailing a decent amount of automobile exhaust into the environment. Also, at the return journey same vehicle picks up any staff from the destination to the campus. The carpooling system being implemented here apart from contributing to the reduction in the air pollution also keeps people more socially responsible by making them to share a common vehicle.

VI. EXPERIMENTAL RESULTS

The GPRS modem used in SMS and Voice call Gateway was controlled initially using AT commands through PIC16F877A. We used the Microchip's MPLAB IDE for the assembly programming of the microcontroller. Figure 5 shows the software simulation of the PIC microcontroller and the GPRS modem direct interface done using PROTEUS simulation tool. Its virtual terminal outputs shown in Figure 6 contain the AT Commands needed for the GPRS Modem to function. A blinking red light on the modem indicated that the modem was correctly connected using the serial port. GPRS modem was tested via PC's HyperTerminal to send SMS messages to the intended mobile number. The GPRS modem used could support placing calls to the police station and also sending SMS to the desired number.

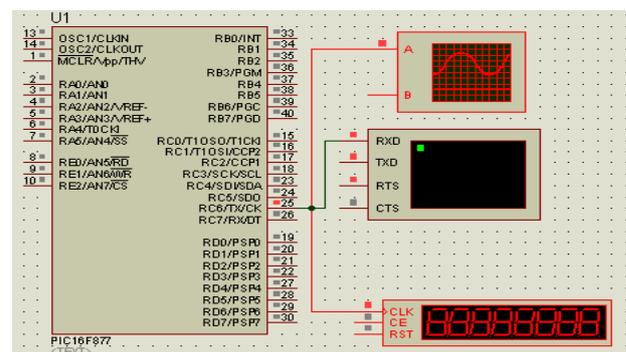


Figure 5. PROTEUS simulation of PIC-GPRS Modem serial interface



Figure 6. AT Commands seen on Virtual Terminal

GSM/GPRS modem can be used to send messages and also make a call through computer. HyperTerminal can be used to control the modem as shown in [5]. For interfacing HyperTerminal with modem there are some steps which we should follow.

A. Setting up GSM modem

GSM/GPRS modem is connected to the computer using a RS-232 cable. It is connected to the serial port of the computer. The GSM modem will map itself as a COM serial port in the computer.

B. Hyper Terminal configuration

- On the Windows Start menu, select the Run dialog box and type hypertrm.exe.
- On the Connection Description screen, type a name and an icon is selected for the definition. The Connect To dialog box appears.
- The primary COM port is selected for the Connect. The COM Properties dialog appears.
- On the COM Properties dialog box, the following selections are made.

Bits per sec: 115200
 Data bits: 8
 Parity: none
 Stop bits: 1
 Flow control: Hardware

C. Initial Setup AT Commands

To setup and check the status of the GSM modem, we use the following AT commands.

AT Returns a "OK" for confirmation.
 AT+CPIN="xxxx" To enter the PIN for the SIM
 AT+CREG? A "0,1" reply confirms that modem is connected to GSM network
 AT+CSQ Indicates the signal strength, 31.99 is maximum.

D. Sending SMS using AT Commands

AT+CMGF=1 To format SMS as a TEXT message.
 AT+CSCA="+xxxxx" Set the SMS center's number.

To send a SMS, the AT command to use is AT+CMGS.
 AT+CMGS="+yyyyy" <Enter>

The SMS text message here <Ctrl-Z>AT
 The "+yyyyy" is the recipient's mobile number.

E. Making calls using AT Commands

- In the blank HyperTerminal window, type atz and then press Enter. The modem responds with OK. If the modem does not respond with OK, it is not configured properly in Windows.
- Type at+fclass=1 and then press Enter. The modem responds with OK. If the modem responds with Error, type at+fclass=2 and then press Enter. If the modem does not respond with OK, the modem does not support faxing.
- In the HyperTerminal window, type atdt<phone number> and then press Enter. You should hear modem pick up and dial the number.
- Close HyperTerminal.

VII. FUTURE WORKS

The design that is being proposed can be implemented in a city, making use of one CMS and many waiting centers in various parts of the city. Although the initial cost of installation is high, no more maintenance charges are required further. This will also help in reducing environmental pollution. Our future work deals with the implementation and real time working of the proposed design in a city in India. After few years of functioning, we will be able to understand how effective the design has been in curtailing pollution caused due to on road vehicles.

VIII. CONCLUSION

Carpooling system is a very effective means to reduce pollution and the congestion of vehicles in cities. It also provides an eco-friendly way of travel. But, today most of the people prefer private vehicles to travel due to the delay caused in the public transport system and the luxuries provided by private vehicles. Our proposed system can intelligently serve the purpose of carpooling with the help of CMS. Pre-registration with the CMS ensures that only identified people get into the vehicles so that crime can be reduced. The people registered with the CMS are allotted specific days on when they should take their private vehicles CMS makes sure that no inconvenience is caused to its registered passengers. Thus the proposed design for automated carpooling will be effective in reducing the environmental pollution caused due to on road mobile sources.

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