

# Design of Autonomous Vehicle System Using WSN

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**Abstract-**The project deals with the design of autonomous and manual vehicle system using the embedded system with wireless communication. Accident identification and avoidance is the complex problem in the existing method. In this project that problem can be eliminated with help of wireless sensor, ZIGBEE, GPS, GSM, PIC Microcontroller and relay system. The Zigbee is designed to provide comfortable feel to the user. The project also used for monitoring the vehicle with the help of RF camera. The vehicle is operated through PC using wireless Zigbee technology and using wireless camera we can view video on the TV/Monitor. Some of the Wireless sensors are used in this project such as temperature sensor, and IR sensor. These are used to determine the distance of the object, identifying vehicles and avoiding accident etc., This device is an inexpensive which reduces the problem associated with anti-theft control and it provides high security.

**Index Terms-**PIC Microcontroller, Zigbee, GSM, GPS, Wireless sensor, IR Sensor, Relay system.

## I.INTRODUCTION

These days' vehicle robbery cases are higher than any other time; it has got to be fundamental to give a vehicle a superb security with the main solid hostile to burglary gadget. Vehicle focal locking framework guarantees the best ensure to secure your vehicle form various types of burglary cases. It is a vehicle security gadget that offers fantastic insurance to the vehicle. However this framework couldn't demonstrate to give complete security to the vehicle in the even burglary. So a more created framework makes utilization of an inserted framework focused around GSM innovation. A vehicle is stolen every six minutes in India. It is known that millions of people lose their vehicles due to theft and accidents in addition to that there are many people lose their lives due to accidents on the roads. Most cases of theft have been caused by the lack of remote control system. It is known that, traditional systems used to monitor the vehicles, which depends mainly on alarm signal. It has failed to perform its function for alarm

can't many other vehicles have the same alarm signal and many other reasons led to reduce using such systems. To resolve such problems, it is decided to design this system to avoid vehicle theft and to know the current location of the vehicle using at any time. Using GSM technology whereas this system also enhances personal safety of individuals. The main aim of the present research is to design and develop an advance and robust security system for vehicle that can prevent theft and provides information on robberies. The system being developed through the present work uses GSM system and can be made affordable so that it can be used in low cost vehicle even in two wheelers. A lot of researches have been done for vehicle safety system depend mainly on GPS. Wireless sensor networks, sometimes called wireless sensor and actuator networks are spatially

distributed autonomoussensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling *control* of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on.

Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "notes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly

variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.

The technology defined by the Zigbee specification is intended to be simpler and less expensive than other wireless personal area networks, such as Bluetooth or Wi-Fi. Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that requires short-range low-rate wireless data transfer. Its low power consumption limits transmission distances to 10–100 meters line-of-sight, depending on power output and environmental characteristics. Zigbee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. Zigbee is typically used in low data rate applications that require long battery life and secure networking.

II. SYSTEM DESIGN

Nowadays crime rate is increasing day by day as it is quite evident from the fact that thefts have become a matter of routine. The vehicle thefts particularly cars may incur huge loss on the part of the amount invested on these vehicles. Therefore, the need of the hour is a better anti-theft control system that can be implemented by using several technologies like ZIGBEE, GPS, GSM, GPRS systems. However these systems will provide only the location of the car. In this proposed system it provides security of autonomous vehicle system controlled by using UART protocol. It also provides high security and easy to handling.

The block diagram shown in Figure 1 completely depicts the components involved in the implementation of the embedded security system.

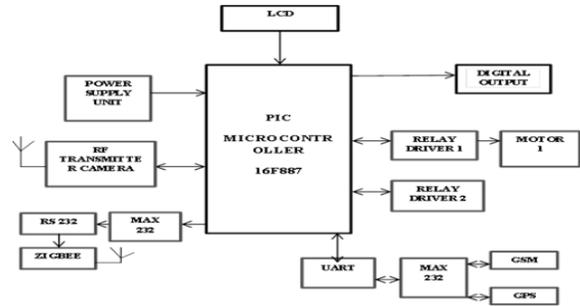


Figure 1 : Block diagram of Transmitter

III .PROPOSED SYSTEM

An electronic system proposed in this paper has the following objectives:

- (i) Locking of the car by sending SMS from the user mobile phone to the GSM modem installed in the car.
- (ii) Unlocking of the car by sending SMS from the user mobile phone to the GSM modem installed in the car.
- (iii) Switching ON the car engine by sending SMS from the user mobile phone to the GSM modem installed in the car.
- (iv) Switching OFF the car engine by sending SMS from the user mobile phone to the GSM modem installed in the car.
- (v) Wherever car is moving , it will be monitoring for user using RF camera.

IV. RELAY

A relay is electrically operated switch. Many relays use an electromagnet to operate a switching mechanism circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly drive an electric motor is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays".

V. GSM (Global System for Mobile communication)  
 The SMS specification has defined a way for a computer to send and receive messages through a mobile phone or a GSM modem. A GSM modem is a wireless modem that works with GSM wireless networks. This wireless modem transmits the data through the wireless network. To send the SMS messages, first a valid SIM card is placed from a wireless carrier into a mobile phone or a GSM modem, which is then connected to the computer. There are several ways of making interaction between a computer and a mobile phone. These are through the USB cable, Serial cable, Blue Tooth link or an infrared link. But the actual way to use depends upon the capability of the GSM modem or mobile phone.

If a mobile phone does not support Blue Tooth, it cannot get connected to the computer through the Blue Tooth link. After connecting the mobile or GSM modem, we can control the system by sending the instructions to it that is in the form of messages. The instructions that we give and the messages we receive is fully controlled by the software that we are using to control the system. We should write a source code for connecting the mobile to the system and sending and receiving commands to and fro between the GSM modem and the system.

VI. PIC MICROCONTROLLER

Microcontroller is used for wide range of Applications because it is low in cost and easily available. The Microcontroller used in this system is 16F887 operating at a frequency of 20MHz. This PIC acts like analyzer that will analyze a serial signal from PC and produce a PWM (Pulse Width Modulation) combined with Electronic Speed Controller (ESC) that has high current spec to control high power motor. The operating voltage needed to operate this microcontroller ranges from 2 to 5.5 Volts. It has 35 Input/output pins. It has 256 bytes of EEPROM memory. The data in it can be written about 1,000,000 times. It has 368 bytes of RAM memory. It has 14 channel A/D converters and 3 independent timers.

This microcontroller is used to run an algorithm and controls other peripherals of the system required to position the actuators of the lighting system. Sensor is directed to the microcontroller. Then the Microcontroller identifies the received command and then performs the assigned task PIC 16F887 is one of

the most advanced microcontroller from Microchip. This controller is widely used for experimental and modern applications because of its low price, wide range of applications, high quality, and ease of availability.

GPS( Global Positioning System)

GPS technology became a reality through the efforts of the American military, which established a satellite-based navigation system consisting of a network of 24 satellites orbiting the earth. GPS is also known as the NAVSTAR (Navigation System for Timing and Ranging). GPS works all across the world and in all weather conditions, thus helping users track locations, objects, and even individuals! GPS technology can be used by any person if they have a GPS receiver. This technique was initially developed for military applications. During 1980, the government decided to make it available for the civilian use as well. GPS has become an efficient tool in the field of scientific use, commerce, surveillance and tracking.

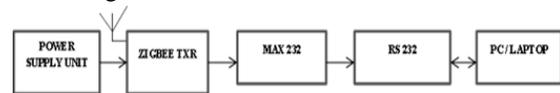


Figure 2 : Transmitter Block

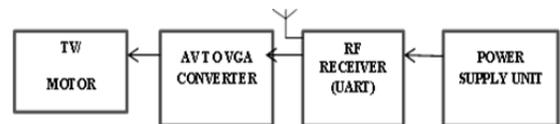


Figure 3: Receiver Block

GPS is used except in locations where it is difficult to detect the signal for example, underwater, subterranean location, inside the building and caves. The satellites are the heart of the Global positioning system which helps to locate the position by broadcasting the signal used by the receiver. The signals are blocked when they travel through buildings, mountains, and people. To calculate the position, the signals of four satellites should be locked. You need to keep moving around to get clear reception.

VII. ZIGBEE

ZigBee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-

bandwidth needs, designed for small scale project which need wireless connection.

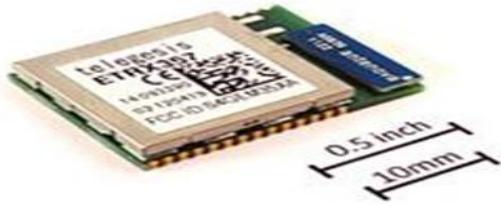


Figure 4: ZIGBEE Model

International standard	IEEE 802.15.4
Developed by	ZigBee Alliance
Industry	Industrial, scientific & medical
Physical range	10 to 20 meters (approx)

The technology defined by the ZigBee specification is intended to be simpler and less expensive than other wireless personal area networks, such as Bluetooth or Wi-Fi. Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that requires short-range low-rate wireless data transfer.

Its low power consumption limits transmission distances to 10–100 meters line-of-sight, depending on power output and environmental characteristics. ZigBee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. ZigBee is typically used in low data rate applications that require long battery life and secure networking. ZigBee has a defined rate of 250 kbit/s, best suited for intermittent data transmissions from a sensor or input device.

ZigBee was conceived in 1998, standardized in 2003, and revised in 2006. The name refers to the waggle dance of honey bees after their return to the beehive. ZigBee is a low-cost, low-power, wireless mesh network standard targeted at the wide development of long battery life devices in wireless control and monitoring applications. Zigbee devices have low latency, which further reduces average current. ZigBee chips are typically integrated with radios and with microcontrollers that have between 60-256 KB of flash memory. ZigBee operates in the industrial, scientific and medical radio bands: 2.4 GHz in most jurisdictions worldwide; 784 MHz in China,

868 MHz in Europe and 915 MHz in the USA and Australia. Data rates vary to 250 kbit/s.

The ZigBee network layer natively supports both star and tree networks, and generic mesh networking. Every network must have one coordinator device, tasked with its creation, the control of its parameters and basic maintenance. Within star networks, the coordinator must be the central node. Both trees and meshes allow the use of ZigBeerouters to extend communication at the network level.

## VIII. SIMULATION OUTPUT

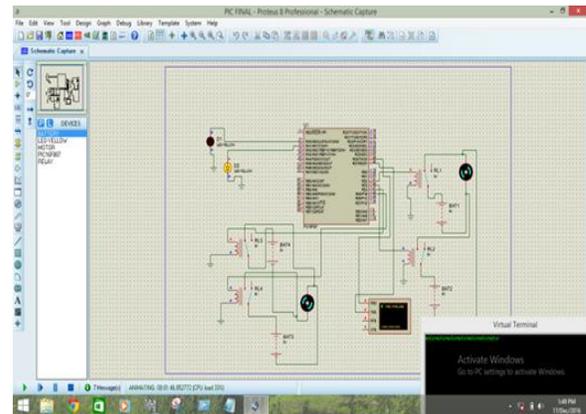


Figure 5: Simulation Output

## IX. DESCRIPTION

- Press 0 = Turn OFF LED 1
- Press 1 = Turn ON LED 1
- Press 2 = Turn ON LED 2
- Press 3 = Turn OFF LED 2
- Press 5 = Motor Rotate In Same Direction (Clockwise)
- Press 6 = Motor Rotate In Same Direction (Anti-Clockwise)
- Press 7 = Rotate In Rights Side
- Press 8 = Rotate In Left Side
- Press 9 = Stop

## X. CONCLUSION AND FUTURE WORK

Accident identification and avoidance is the complex problem in the existing method. In this project that problem can be eliminated with help of wireless sensor, Bluetooth connectivity, GPS, GSM, ZIGBEE and remote system. The embedded Bluetooth is designed to provide comfortable feel to the user. Some of the Wireless sensors are used in this project such as ultrasonic sensor, obstacle sensor. These are used to determine the distance of the object,

identifying vehicles and avoiding accident etc, This device is an inexpensive which reduces the problem associated with anti-theft control and it provides high security.

This paper has presented the on-going research being undertaken to investigate the Suitability of using PIC Microcontroller, ZIGBEE Transmitter/Receiver. The car of the future will be different. The work presented here demonstrates the initial phase of such an embedded car that will be visible in near future. Customized vehicles will not only provide a more interesting drive but also a safer one, and will become a major time saver. The main idea behind this project is to engineer all embedded related technology to make a drive a smart just drive.

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