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Personal Handy System Based Online Vehicle Tracking With Mobile Locking

Mrs. R. S. Sewane*, Prof (Dr) H. V. Vankudre**, Prof M. N. Kakatkar***
(Department of Mechanical Engineering, Sinhgad College of Engg.Pune,Pune University, Pune-41)
***(Department of Electronics and Telecommunication Engineering, Sinhgad College of Engg.Pune, Pune University, Pune-41)

ABSTRACT
This paper presents the detailed description about "Personal Handy System" (PHS) which is the alternative technology for Global Positioning System (GPS).PHS is a effective system for network system of vehicle tracking & locking facility from a remote end like control room or even vehicle owner's mobile. The operator can see the vehicle's current location in real time mode. Here the communication network is comparable to the cellular network in operation.In this paper prototypes are made to illustrate the tracking and locking of vehicle.
Keywords **–** Global Positioning System, Personal Handy System,Vehicle Tracking,Mobile Network

I. INTRODUCTION

The Global Positioning System is used to track the vehicles using Low Earth Orbit Satellites continuously in present scenario. But if the vehicle moves beyond the network area, it will not be possible to track the vehicle using GPS, to overcome this problem personal handy system is provided which works even if the vehicle is in not reachable area. The Personal Handy System (PHS) service was launched first in 1995 to respond to the diversified demand of mobile communication in Japan. In January 2000, PHS network services with Kyocera cell stations were started in China. Since then, subscribers have been steadily increasing in China and Impressive development centering on Southeast Asia is also seen to be growing. Kyocera has been the major supplier of PHS equipment in Japan as well as in China and Southeast Asian market.

II. SYSTEM OVERVIEW

A. Host Controller

Host controller represents the section where user can get the messages of vehicle location.

Working of Host Controller

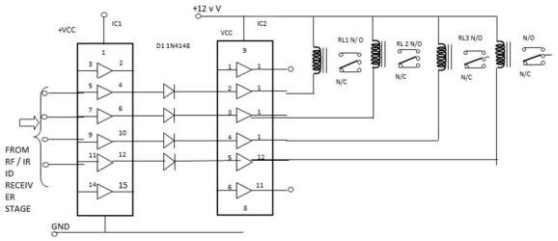

Fig. 1 Circuit Diagram of Host Controller

In Fig 1,Interconnection of buffer, driver and relay is given. The IR ID received from cell broadcaster is decoded in 4 signals and given to the buffer for signal conditioning and to remove noise. Signal from buffer is then fed to driver IC. Relay needs 12 V to activate hence drivers are used. The normally open terminal of relay is connected to micro controller's port 3, which is taken as input signal for identification of area. Zener diodes are used in between buffer and driver 3, for protection.

The Hex Buffer/Inverter IC1 has six input/outputs but only four are used in the present circuit. The working voltage of +5V is applied at pin-1 and four control signals are applied at input pins 5, 7, 9 & 11. Thus the signal supplying circuit is isolated from this Buffer & Driver circuit and the varying input is further stabilized and fed to signal diodes. As the load may be anything [especially inductive], there is a chance of producing back e.m.f. So to cope with this back e.m.f, signal diodes are used. But this signal level is not strong enough to drive the low impedance relay. So, Darlington driver IC2 is used. Its working voltage is +12 V and only four input/output pins are used. The output signal from the Darlington driver IC is strong enough to actuate four relays. These relays with +12V working voltage are used to supply 4-bit RF / IR ID decoded signal to Computer for further processing. That is, each relays N/O [Normally Open] pins are used state that the particular bit is high.

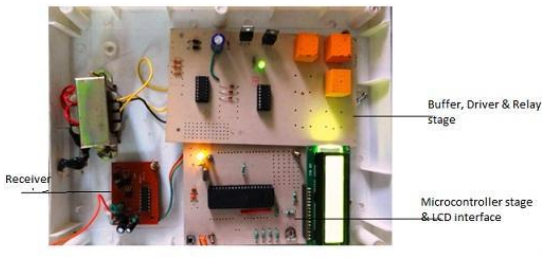

Fig. 2 Photographic View of Host Controller

B. CELL BROADCASTER

Cell broadcaster is nothing but VHF/IR Transmitter and IR / ID Receiver unit. Cell broadcaster is used into three areas namely,

- Area A
- Area B
- PHS Area

IR Receiver:

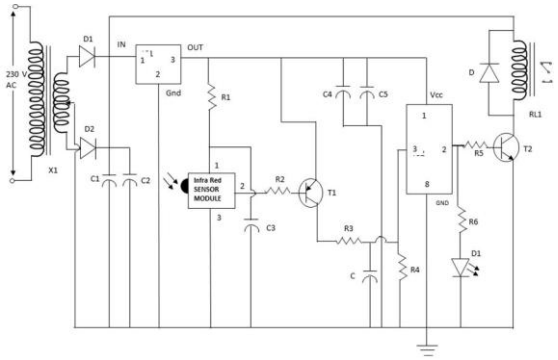

Fig. 3 Circuit Diagram of IR receiver unit.

The 'packets' of Radio Frequency signals transmitted from the RF / IR ID Transmitter of the moving vehicle is received by this unit.The chip is used to receive the transmitted signals and decodes it to give the output in 4-bit format. Fig 3 shows the circuitry of IR Receiver unit.

This circuit activates the relay whenever there is a presence of Infra Red Rays. The working principle of this module is very simple: The mains voltage is step-down to 6V using a transformer. This secondary 6V is rectified using full-wave rectifier, which is composed by D1 & D2 diodes. This is further filtered using electrolytic capacitor C2 and fed to regulator IC1. This three-terminal IC stabilizes the input and gives out the constant +5V as working voltage for the circuit.

The IR Sensor Module has 3 terminals: signal input, supply pin and the ground pin. This module works on regulated +5Votls, and exceeding this limit may cause the damage of it. So, this Sensor is given Vcc through a biasing resistor R1 and grounded pin is given to negative terminal of the supply. Whenever the Infra Red rays falls on this Sensors eye [that black mole on Sensor] it produces varying signal voltages at output pin. This is given to amplifier stage built by an PNP transistor TR1 through an current limiting resistor R2. The output of this amplifier is fed to a buffer situated in IC2. This buffer or converter enhances the current capacity of the signal and send to driver stage. The signal output is monitored by observing the glowing indicator LED D4.

The driver is built around TR1 and a low-impedance relay. The signal diode D3 is there to prevent the back e.m.f produced by the switching action of the relay. As the signal from the buffer enters the base of TR2 it undergoes saturation and makes the relay ON/OFF. When there is no IR rays 'eye' stops sending signals to TR2 base. Hence it enters the cut-off region and switches the relay OFF/ON. Thus this circuit can be used the switch ON/OFF the mains operated loads from the remote area using a wireless communication. The circuit is fully stabilized from the false triggering and other interferences. This is achieved by using capacitors at proper places. As this is an Unlatch Circuit the relay actuates only when the IR beams are present at the 'eye' of the sensor module. And releases the switching as-soon-as there are no IR radiations.

VHF/IR transmitter

Fig 4 is the circuit diagram of IR transmitter

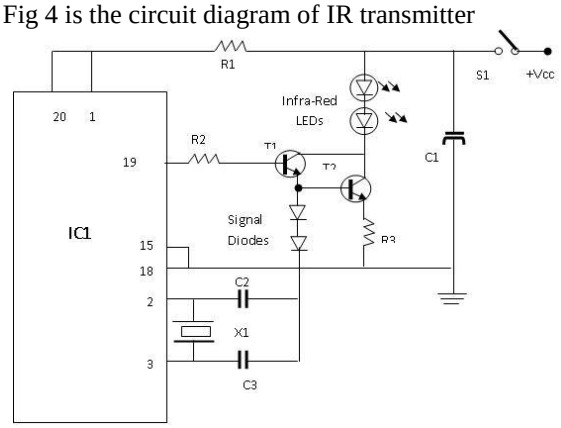

Fig 4 Circuit Diagram of IR transmitter

The Infra Red Transmitter is made very simple by employing the dedicated & commercially available IC1. Here the IC1 is used in flash mode by connecting Transmission Mode Pin 1 to +Vcc, and thus reduces average current consumption to 6.5 mA. In this mode minimum and maximum transmission times are 2.1 milliseconds and 3.6 milliseconds respectively and the duty cycle is 0.7%.

Since the Circuit is intended to send only one signal code, IC1 is configured for address one [refer the table in IC description] by making all the Address Input pins, Code pins to zero or ground. As soon the switch S1 is switched ON, the circuit gets its working voltage of 9 Volts through pin-20. Inside the IC, it creates the address 1 as a command code and sent to the output pin-19. This command signal output from the IC1 is given through a resistor R1 to the base of the Transistor T1. The output from this transistor T1 is fed to the base of another Transistor T2. These two transistors amplify the command signal to the sufficient level and then drive the IR LEDs. The Collector of both the transistors is connected to the pair of Infra Red LEDs. When the transistor T2 goes to saturation region, that means starts conducting, the current will flow through the two series IR LEDs. Thus they illuminate for that period and gets off. This

process continues as per the switch S1 is pushed ON and the pulses will be sent through IR LEDs continues. Thus the command signal is transmitted to IR receiver successfully.

PHS Satellite

The use of PHS system increases range of detection as it includes satellite. The cell broadcaster unit in PHS system is same as that of the other area with the exception that the other units send IR ID directly to host controller while PHS will send ID to controller through satellite. The direct transmission restricts the area to the smaller distances. With satellite the vehicle can be detected from anywhere. In this project a prototype of satellite is build to increase the range as shown in Fig 5,whose working is same as that of Area A and Area B.

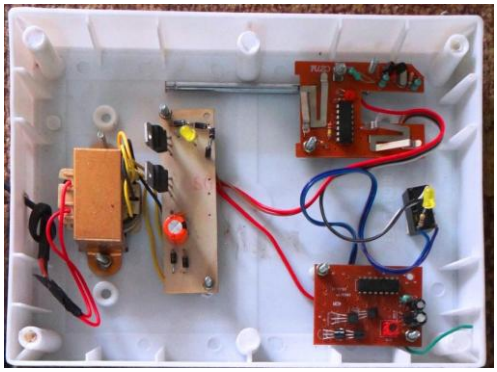

Fig 5: Satellite for PHS Area

C.VEHICLE LOCKING SYSTEM

This is a rear wheel drive vehicle. D.C. motor is located at the centre of the rear axle, which gives power to the rear wheel and the D.C. motor is operated by battery power. Spur gears are provided for vehicle speed reduction.. There is no necessity to change the direction of vehicle for the system implemetation so steering system is not provided on the vehicle.

Motor is connected to battery and circuit unit. The circuit is nothing but the RF transmitter and DTMF decoder module fixed on the vehicle to receive the signal from the mobile and transmit it to the cell broadcaster unit of various areas so that the signal will get transmitted to the receiving end of Host Controller unit and with the help of respective channel code the message will get displayed on LCD located on Host Controller unit and thus it will be easy to locate the position of the vehicle.

III. WORKING OF SYSTEM

The method for implementation of this system is provided in this section. Fig 6 is the general block diagram of system.

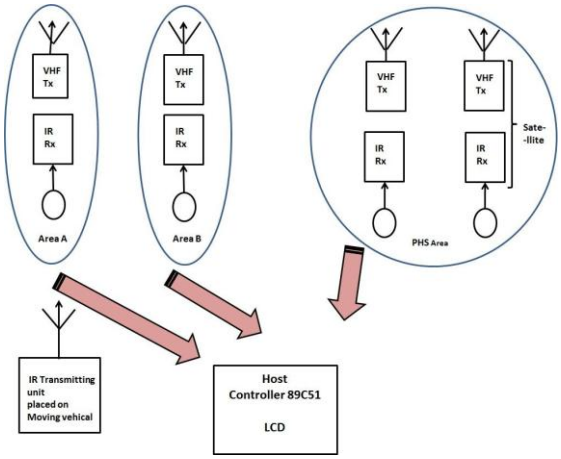

Fig 6: Tracking System Overview

1. There are three modules Area A, Area B, PHS Area.
2. All the three modules should be connected to the socket at a distance of approximately 6 to 7 ft.
3. The Host controller unit should be placed in the centre of all the three areas and should be connected to the socket.
4. The mobile should be connected to the jack provided on the vehicle and should be put on auto receiver mode.
5. The call should be made from other mobile to the mobile which is attached to the vehicle, it will be automatically received at it is on auto-receive mode.
6. The vehicle should be start by pressing key '1' of mobile and thus the vehicle should run across the various areas i.e. modules.
7. As soon as the vehicle reaches Area A, the IR/ID transmitted by vehicle unit is received by IR receiver of Area A. The particular code for channel is then sent by VHF transmitter to Host controller, RF/VHF signal is received by receiver and then interfaced to microcontroller by a set of buffer circuit, driver stage, and relay switching network and to the parallel port.
8. The LCD present on LCD and Microcontroller stage should display the name of area i.e. Area A, and thus the user will come to know that vehicle is in Area A.
9. The vehicle should be move near area B, as soon as it reaches Area B, the message displayed on the LCD will be Area B.
10. The PHS area needs satellite to increase the frequency range so the satellite module should also be connected to the socket.
11. The vehicle should be move in PHS Area now the message and the message displayed on LCD should be PHS Area.
12. The vehicle can now be stop by pressing key '2' of the mobile.

IV. CONCLUSION

Validation of Tracking System

Tracking unit of this system detects the infrared signal coming from vehicle and transmits the corresponding vehicle ID to the host controller and satellite module. The IR transmitter module placed on vehicle runs on 3V DC power supply. The broadcaster unit is powered by 5V.

The system is tested by moving vehicle in different zones that is A,B,C and PHS placed at about 7 ft away. When the vehicle travelled into area A the IR rays from vehicle transmitter unit were detected by transceiver unit of area A. The transceiver sent code corresponding to area A, which is detected by host controller. The 3 bit combination is given input to driver and buffer. The output of driver is 5V for '1' and 0V for '0'. This output voltage is used to drive three relays. Relay coils are activated with 12V supply. The normally close terminal of each relay is connected to ground, normally open terminal is connected to port 3 pins while input terminal is connected to 5V. The microcontroller then compares the received code on port 3 to the code assigned for each area and displays corresponding area on LCD.

The same procedure is followed for PHS module validation. PHS unit includes one additional transceiver unit which prototyped as satellite. This unit increases the area covered for vehicle detection. The broadcaster unit and satellite unit are placed away; when the IR signal from vehicle is detected by PHS unit it transmits the code for the respective area to the satellite module instead of host controller. This activates the relay of satellite module which transmits same code to the host. The corresponding area is displayed on LCD as PHS area.

The transmission is in the form of light hence any opaque object of glass causes the interruption in transmission and the host controller cannot detect the signal.

Validation of Locking System

The remote locking system stops the vehicle when it is stolen using owner's mobile phone. This is achieved using DTMF decoder technique. For the demonstration of locking system one mobile is placed on vehicle which is kept on auto receive mode. When a call is received from the mobile placed remotely digit '1' is used to move the vehicle and digit '2' stops the vehicle.

In DTMF decoding each digit is assigned two frequencies that is dual tone. One of the frequencies is from higher band while other is a low frequency. When one is pressed the frequencies related to digit 1 are transmitted by owner's mobile and received by mobile placed on vehicle. This digit is decoded by DTMF decoder IC. Output of this IC is given to the relay. The received digit 1 activates the relay and 0 deactivates the same. When the relay is active is gives 9V to the DC motor to run while the deactivation of relay gives 0V which stops the motor..

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