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WSN Based Traffic Control System for Congestion Control for Ambulance Clearance, and Stolen Vehicle Detection

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ABSTRACT:

This project represents an intelligent traffic control system to run emergency vehicles smoothly. Each individual vehicle is equipped with unique radio frequency identification tag (placed at a strategic location),this is impossible to remove or destroy. We use RFID reader, and LPC2148 system-on-chip to read the RFID tags attached to the vehicle. RFID counts the number of vehicles that are passed on the particular way during a specific duration. It also determines the network congestion, and then the green light is on for some duration for that path. If the RFID-tag-read belongs to the stolen vehicle, then a message is sent using GSM SIM900 to the police control room and to the owner of the vehicle. In addition, when an ambulance is coming to that particular junction, RFID will communicate the information to the traffic controller in the junction to turn ON the green light. This module uses ZigBeetechnology on CC2500 and LPC2148 system-on-chip for communications between the ambulance and traffic controller. The prototype was observed under different combinations of inputs in our wireless communication laboratory and experimental results were accurate.

INTRODUCTION

A system is something that maintains its existence and functions as a whole through the interaction of its parts. E.g. Body, Mankind, access Controlled. A system is a part of the world that a person or group of persons during some time interval and for some purpose choose to regard as a whole, consisting of interrelated components, each component characterized by properties that are selected as being relevant to the purpose. An embedded system is a combination of software and Hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers.

Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result. Intelligent traffic control system to pass emergency vehicles smoothly.

Each individual vehicle is equipped with special radio frequency identification (RFID) tag (placed at a strategic location), which makes it impossible to remove or destroy. We use RFID reader, NSK EDK-125–TTL, and LPC2148 system-on-chip to read the RFID tags attached to the vehicle. It counts number of vehicles that passes on a particular path during a specified duration.

It also determines the network congestion, and hence the green light duration for that path. If the RFID-tag-read belongs to the stolen vehicle, then a message is sent using GSM SIM900 to the police control room. In addition, when an ambulance is approaching the junction, it will communicate to the traffic controller in the junction to turn ON the green light. This module uses Zigbee modules on CC2500 and LPC2148 system-on-chip for wireless communications between the ambulance and traffic

Functional Areas of Existing Systems:

in this project existing method The existing systems which are related to traffic systems are just normal. We can't see any extra facilities to normal traffic systems. But in proposed system traffic system has some more facilities to perform user continence.

Proposed System:

In proposed system normal traffic system converted into some smart traffic system. It can give right signals to ambulance and I can intimate stolen vehicles.

The aim of the project is intelligent traffic control system to pass emergency vehicles smoothly and stolen vehicles and easy monitoring the traffic signals . All the devices such as 16X2 LCD, Zigbee, lpc2148,rfid reader, GSM are being interfacing to microcontroller which forms the control unit of the project. The uniqueness of this project is, it sends a caution SMS to mobile number as well as it post the values in by using zigbee and gsm technology. This project Implementing Intelligent Traffic Control System for Congestion Control, Ambulance Clearance, and Stolen Vehicle Detection" is used as whenever the Rechargeable Battery and solar system can be connected to this system to enable it to work in power failure conditions also.

. . It mainly consists of three parts. First part contains automatic signal control system. Here, each vehicle is equipped with an RFID tag. When it comes in the range of RFID reader, it will send the signal to the RFID reader. The RFID reader will track how many vehicles have passed through for a specific period and determines the congestion volume. Accordingly, it sets the green light duration for that path. Second part is for the emergency vehicle clearance. Here, each emergency vehicle contains ZigBee transmitter module and the ZigBee receiver will be implemented at the traffic junction. The buzzer will be switched ON when the vehicle is used for emergency purpose. This will send the signal through the ZigBee transmitter to the ZigBee receiver. It will make the traffic light to change to green. Once the ambulance passes through, the receiver no longer receives the ZigBee signal and the traffic light is turned to red. The third part is responsible for stolen vehicle detection. Here, when the RFID reader reads the RFID tag, it compares it to the list of stolen RFIDs. If a match is found, it sends SMS to the police control room and changes the traffic light to red, so that the vehicle is made to stop in the traffic junction and local police can take appropriate action. List of components used in the experiment are CC2500RF module, Microchip LPC2148, RFID Reader–125KHz–TTL and SIM900 GSM module.

BLOCK DIAGRAM

Transmitter block Diagram of the WSN BASED Traffic Control System for Congestion Control, Ambulance Clearance, and Stolen Vehicle Detection

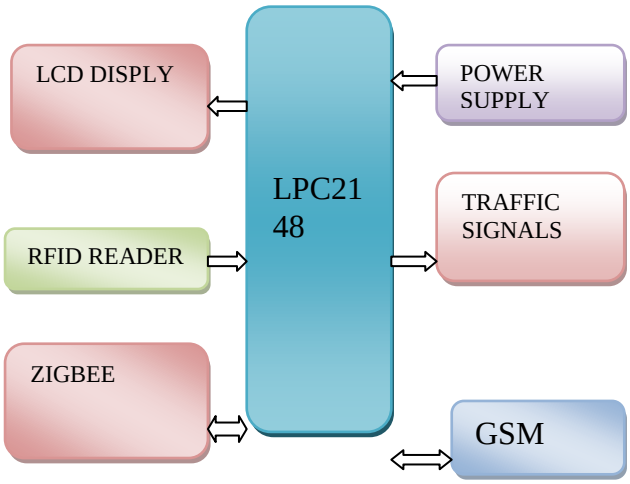
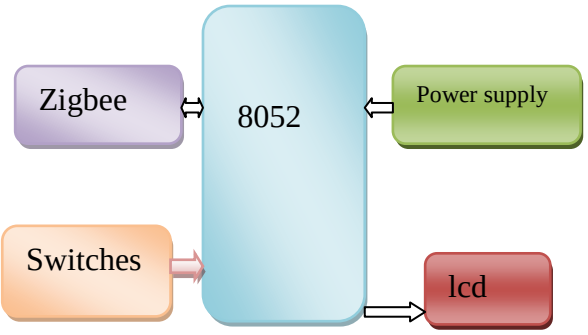


Fig. 1 MAIN SYSTEM BLOCKDIGRAM

The below figure shows the receiver section(vehicle section) of an Implementing Intelligent Traffic Control System for Congestion Control, Ambulance Clearance, and Stolen Vehicle Detection.



HARDWARE DESCRIPTION

Sensor Network:

Proposed system contains system normal traffic system converted into some smart traffic system. It can give right signals to ambulance and I can intimate stolen vehicles.

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RFID: Radio-frequency identification

RFID chip next to a grain of rice. RFID chips contain a radio-frequency electromagnetic field coil that employs a magnetic field to emit a coded identification number when queried by a reader device. This small type is incorporated in consumer products, and even implanted in pets, for identification.

Radio-frequency identification (RFID) is the use of a wireless non-contact system that uses radio-frequency electromagnetic fields to transfer data from a tag attached to an object, for the purposes of automatic identification and tracking. Some tags require no battery and are powered by the electromagnetic fields used to read them. Others use a local power source and emit radio waves (electromagnetic radiation at radio frequencies). The tag contains electronically stored information which can be read from up to several metres (yards) away. Unlike a bar code, the tag does not need to be within line of sight of the reader and may be embedded in the tracked object.

ZIGBEE MODULE: The X-Bee RF Modules interface to a host device through a logic-level asynchronous Serial port. Through its serial port, the module can communicate with any logic and voltage Compatible UART; or through a level translator to any serial device.

Data is presented to the X-Bee module through its DIN pin, and it must be in the asynchronous serial format, which consists of a start bit, 8 data bits, and a stop bit. Because the input data goes directly into the input of a UART within the X-Bee module, no bit inversions are necessary within the asynchronous serial data stream. All of the required timing and parity checking is automatically taken care of by the X-Bee's UART.

.Microcontroller:

The NXP (founded by Philips) LPC2148 is an ARM7TDMI-S based high-performance 32-bit RISC Microcontroller with Thumb extensions 512KB on-chip Flash ROM with In-System Programming (ISP) and In-Application Programming (IAP), 32KB RAM, Vectored Interrupt Controller, Two 10bit ADCs with 14 channels, USB 2.0 Full Speed Device Controller, Two UARTs, Two I2C serial interfaces, Two SPI serial interfaces Two 32-bit timers, Watchdog Timer, PWM unit, Real Time Clock with optional battery backup, Brown out detect circuit General purpose I/O pins.

GSM:

The GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services. GSM differs from first generation wireless systems in that it uses digital technology and time division multiple access transmission methods. GSM is a circuit-switched system that divides each 200 kHz channel into eight 25 kHz time-slots; GSM supports data transfer speeds of up to 9.6 Kbit/s, allowing the transmission of basic data services such as SMS (Short Message Service). Another major benefit is its international roaming capability, allowing users to access the same services when traveling abroad as at home. This gives consumers seamless and same number connectivity in more than 210 countries. GSM satellite roaming has also extended service access to areas where terrestrial coverage is not available.

***LCD*:**

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

Stolen Vehicle Detection System:

In this module, for testing purpose, we compare the unique RFID tag read by the RFID reader to the stolen RFIDs stored in the system. If a match is found, then the traffic signal is immediately turned to red for a duration of 30 seconds. Also an SMS is sent specifying the RFID number by using SIM900 GSM module. The LCD display will indicate that stolen vehicle is present.

Emergency Vehicle Clearance System:

In this module, there are 2 parts, first part which is ZigBee transmitter is placed in the emergency vehicle. When the switch is pressed, it will transmit the signal. The signal contains unique id and security code. The transmitter contains LPC2148 microcontroller and ZigBee module. The microcontroller sends the commands and data to the ZigBee via serial communication. Second part is the receiver, which is placed at traffic pole. It also contains LPC2148 microcontroller and ZigBee module. The receiver compares the security code received to the security code present in its database. If it matches, then it will turn the green light on. For testing purpose, we used short range RFID reader in our prototype. First, the receiver part is turned on. The red and green signal will be on for 10 seconds duration and orange light will be on for 2 seconds duration one after the other. Secondly, we bring the RFID of stolen vehicle into the range of RFID reader. Then the signal will turn to red for duration of 30 seconds and a SMS is received. Thirdly, we bring 12 RFIDs into the range of RFID reader, and then the green light duration will change to 30 seconds

Proposed algorithm

Algorithm for the proposed system is divided in two parts as

1. Initialize SPI (Serial Peripheral Interface).
2. Initialize LCD.
3. Initialize GSM, GPS.
4. Initialize all RFID TAG.
5. Display status of the type of vehicle.
6. If the vehicle with RFID passes message is displayed on lcd.
7. Then the traffic of the road is clear, and green light is on for that particular vehicle.
8. If any stolen vehicle passes in that area then send SMS to police control room, alerting system on.
9. Then particular action can be taken.

Working model and test Results

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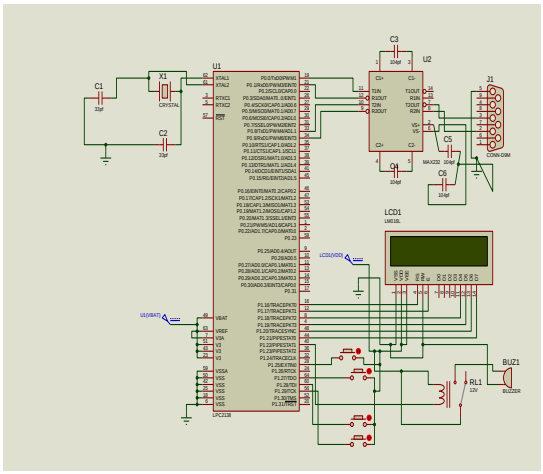
CIRCUIT DIAGRAM



CONCLUSIONS:

With automatic traffic signal control based on the traffic density in the route, the manual effort on the part of the traffic policeman is saved. As the entire system is automated, it requires very less human intervention. With stolen vehicle detection, the signal automatically turns to red, so that the police officer can take appropriate action, if he/she is present at the junction. Also SMS will be sent so that they can prepare to catch the stolen vehicle at the next possible junctions. Emergency vehicles like ambulance, fire trucks, need to reach their destinations at the earliest. If they spend a lot of time in traffic jams, precious lives of many people may be in danger. With emergency vehicle clearance, the traffic signal turns to green as long as the emergency vehicle is waiting in the traffic junction. The signal turns to red, only after the emergency vehicle passes through. Further enhancements can be done to the prototype by testing it with longer range RFID readers. Also GPS can be placed into the stolen vehicle detection module, so that the exact location of stolen vehicle is known. Currently, we have implemented system by considering one road of the traffic junction. It can be improved by extending to all the roads in a multi-road junction.

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