

International Journal of Advance Research in Computer Science and Management Studies

Research Paper

Available online at: www.ijarcsms.com

Design of Intelligent Traffic Control System Based on ARM

Ashwini Y. Dakhole¹

Department of Electronics & Telecommunication Engineering
G. H. Raisoni Institute of Engineering and Technology for women
Nagpur - India

Mrunalini P. Moon²

Assistant Professor
Department of Electronics & Telecommunication Engineering
G. H. Raisoni Institute of Engineering and Technology for women
Nagpur - India

Abstract: With ARM7 as the core, this paper discusses a design of traffic control system. The new architecture and design theory of this system is integrated by lot of hardware modules such as ARM LPC 2148 microcontroller as a control unit to combine with global positioning system and CC2500 RF module by the hardware/software co-design, the new traffic control system can be design. The traffic congestion can be caused by large Red light delays in the normal traffic control system. The ARM7 based traffic control system proposes a multiple traffic light control and monitoring system that reduce the possibilities of traffic jams, caused by traffic lights. The system is based on ATmega16 and ARM7.

Keywords: ARM7, ATMEGA 16 microcontroller, IR (infrared) sensor, RF trans-receiver module, GPS.

I. INTRODUCTION

Traffic research has the goal to optimize traffic flow of people and goods. As the number of road users constantly increases, and resources provided by current infrastructures are limited, intelligent control of traffic will become a very important issue in the future. However, some limitations to the usage of intelligent traffic control exist. Avoiding traffic jams for example is thought to be beneficial to both environment and economy, but improved traffic-flow may also lead to an increase in demand. There are several models for traffic simulation. In our research we focus on optimization of traffic light controllers in a city using IR sensor and control traffic using ATMEGA 16 microcontroller.

The traffic control system based on vehicle density calculation tries to reduce possibilities of traffic jams, caused by traffic lights. The system contains three IR transmitter and IR receiver for traffic density measurement which are mounted on the either sides of roads respectively. The IR system gets activated whenever any vehicle passes on road between IR sensors. When one sensor will be ON at that time density will be less when two sensors will be ON at that traffic density is medium when all 3 sensor will be ON at that time density will be high. Microcontroller controls the IR system and counts number of vehicles passing on road. Based on vehicle density calculation, the microcontroller takes decision and updates the traffic light delays as a result. The traffic light is situated at a certain distance from the IR system. Thus based on vehicle density calculation, microcontroller defines different ranges for traffic light delays and update.

Also we use GPS technology to give accidental information about the vehicle. When traffic accidents occur, the system immediately notifies the location of accident to emergency personnel like ambulance by use of GPS technology. Also the system have facility to emergency vehicle detection system like ambulance, police etc. When an emergency car comes on the signal and number of vehicles will be available in front of the emergency vehicle. In this situation, the system will detect the emergency car, and then signal falls RED to GREEN to pass the car by sending signal from emergency vehicle to traffic light sensor system and the signal will be RED for other vehicles, so number of possibility of accident reduces.

II. RELATED WORK

Several works on mobile sensor for traffic monitoring have been carried out in recent years. Most of them have focused on highways or freeways, where a traffic light delay is not an issue in these circumstances. On the contrary, the situation is different from an urban area, where there are traffic light delays. The author Zhang Yuye et.al.[1] system use AT89C51 and CAN BUS controller which leads to complicated design and cost of the system more because of CAN BUS controller. Using AT89C51 power requirement will be more but the proposed ARM7 based traffic control system will use low power Atmega16 microcontroller. So reduce the power required. The author Manoj Kanta Mainali et.al. [2] system used genetic algorithm approach to estimate the traffic volume in road sections without the traffic information on road sections. The system can estimate the unknown traffic volume using only the known traffic volumes. So, proposed ARM7 based traffic control system use the advantage of [1][2] to design very efficient system that use the combination of ARM and AVR.

The author Xu Li et.al. [3] carried out a performance evaluation study by utilizing the existing vehicle- based sensors in taxis for traffic monitoring. A performance evaluation has been carried out in Shanghai, China. ARM based traffic control system based on vehicle density calculation to reduce traffic congestion carried out in India. The author Promila Sinhmar et.al. [4] the system use Image processing to traffic light control and monitoring system. The microcontroller is connected to a computer through a serial communication cable so hardware cost is more. Thus I propose Arm based traffic control system to control the traffic and monitoring system uses Global Positioning System.

III. PROBLEM DESCRIPTION

In typical conventional traffic light controller, there are so many problems occurs which are mentioned below:

A. *Heavy Traffic Jams:*

With increasing number of vehicles on the road, the heavy traffic congestion problem increased in cities. This usually happened in the morning, and in the evening. Due to this, people spend unnecessary time on the road. By developing the program which different setting delays for different junctions, we can solve these problems.

B. *No traffic, but still need to wait:*

At certain junctions, the traffic is clear means there is no traffic but people have to wait until the green light. If people want to go in the red light, they have to pay fine. Our system proposed a solution to this problem which detects traffic flow on each road and set timings of signals accordingly.

C. *Emergency car stuck in a traffic jam:*

At the traffic light junction, a road user waiting for the traffic light turns to green. During a traffic jam, the emergency vehicles such as ambulance, fire brigade, police, etc. will be stuck in a traffic jam. It can cause the emergency case become complicated. This is a very critical problem.

The proposed traffic control system solves this problem in the most effective way. When an emergency car came and number of vehicles are present in front of emergency car then the system give green signal to pass the emergency car and RED for other vehicle which lead to traffic conjunction problem and also leads to accidents, so only emergency cars will pass the signal for a particular time period.

IV. HARDWARE DESIGN

In the current work we have designed following hardware systems are

1. ARM7 board vehicle system.
2. Traffic control system.

1. ARM7 board Vehicle system:

These systems consist of GPS modules, ARM7 embedded module, RFCC2500 transmitter module.

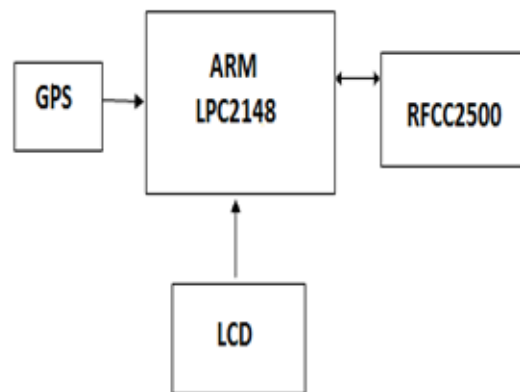


Fig.1 Vehicle System

We use GPS technology to give accidental information about the vehicle. When traffic accidents occur, the system immediately notifies the location of accident to emergency personnel like ambulance by use of GPS technology. RFCC2500 module is used to transmit signals to the control system. The total controller program is developed in embedded C language and is downloaded into the memory for operation.

2. Traffic control system:

This system consist of AVR ATmega16, RFCC2500 receiver module and traffic signal. The conventional traffic signal controller works on the principle of Time division. In this module we are using AVR ATmega16 microcontroller as a base unit. RFCC2500 is used to receive the signal from vehicle system.

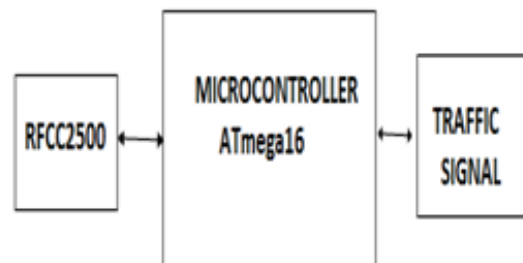


Fig. 2 Traffic Control System

The general time division based traffic signal management will create massive traffic problems in peak hours. The proposed system is an adaptive system based on vehicle density calculation which gives a perfect solution to control the traffic problem.

V. DESIGN SCHEME AND SYSTEMS STRUCTURE

A. ARM7TDMI Microprocessor:

ARM7TDMI processor in our model due to its advanced features described below. 32-bit ARM processor is the contemporary general purpose microprocessor on the embedded market used in industrial level applications. ARM7 consists of a number of peripherals interfaced to it. We use keypad matrix, LCD display, UARTS, GPIO and I2C protocol. ARM7 processor is a link between GPS and GSM modules for communication. The description of ARM7 is discussed in further sections.

Features:

- ✓ 16/32-bit ARM7TDMI-S microcontroller is a 64 or 144 pin package.

- ✓ 16 KB on-chip Static RAM.
- ✓ 128/256 KB on-chip Flash Program Memory. 128-bit wide interface/accelerator enables high speed 60 MHz operation.
- ✓ In-System Programming (ISP) and In-Application Programming via on-chip boot-loader software, flash programming takes 1ms per 512 byte line. Single sector or full chip erase takes 400 ms.
- ✓ B Two 32-bit timers (with 4 capture and 4 compare channels), PWM unit (6 outputs), Real Time Clock and Watchdog.
- ✓ Multiple serial interfaces including two UARTs (16C550), Fast I2C (400 Kbits/s) and two SPIs 60 MHz maximum CPU clock available from programmable on-chip Phase-Locked Loop.
- ✓ On-chip crystal oscillator with an operating range of 1 MHz to 30 MHz
- ✓ Two low power modes Idle and Power-down.
- ✓ Processor wake-up from Power-down mode via external interrupt.

B. ATMEGA16 Microcontroller

The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves through puts approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed.

VI. RESULT

The results include the successful operation of the traffic control and monitoring system. The system contains three IR transmitters and IR receiver for traffic density measurement which are mounted either on the sides of roads respectively. The IR system gets activated whenever any vehicle passes on the road between IR sensors. When one sensor was ON at that time density will be less when two sensors will be ON at that traffic density is medium when all 3 sensors will be ON at that time density will be high. Microcontroller controls the IR system and counts the number of vehicles passing on the road. Based on different vehicles density calculation, the microcontroller takes decision and updates the traffic light delays. The traffic light is situated at a certain distance from the IR system. Thus based on vehicle density calculation, microcontroller defines different ranges.

VII. CONCLUSION AND FEATURE SCOPE

In this paper we have studied the optimization of traffic light controllers in a City using ARM7 and microcontroller. The ARM7 based traffic control system works on traffic related problems such as traffic jam; unreasonable latency time of stoppage of vehicle, emergency vehicles or forcibly passing, etc. can be solved. The system has several benefits such as simple structure, high reliability, low costs, good real-time, easy installation and maintenance and so on. Figure1 and Figure2 show the basic block diagram of the system. By using this system configuration we try to reduce the possibilities of traffic jams, caused by traffic lights. The number of passing vehicle in the fixed time slot on the road decide the density range of traffics and on the basis of vehicle density calculation, microcontroller decide the traffic light delays.

In the future, we can use GSM technology in which GSM module placed with embedded unit in the moving vehicle to transmit accident information to different points. When vehicle accident occurs, the system will detect that vehicle and call the ambulance to a nearby hospital through GSM module. GSM unit is very much reliable and data transmission is faster.

By making it work in real time environment we can directly use video conferencing between the doctor and patient. The medical Real time Wireless technology can be implemented in the same design where in the patients useful parameters will be sent to the hospital unit via hi-tech technology. So that the exact situation of the patient will be known to the doctors and necessary initial treatment could be provided. By creating a WSN network node to node communication can be done.

References

1. Xu Li, Wei Shu, Minglu Li, Hong-Yu Huang, Pei-En Luo, and Min-You Wu, "Performance Evaluation of Vehicle-Based Mobile Sensor Networks for Traffic Monitoring" IEEE 2009
2. Samy Sadeky, Ayoub Al-Hamadi, Bernd Michaelisy, Usama Sayedz, "Real-time Automatic Traffic Accident Recognition Using HFG", 2010 International Conference on Pattern Recognition
3. Malik Tubaishat, Qi Qi, Yi Shang, Hongchi Shi "Wireless Sensor-Based Traffic Light Control", IEEE 2008
4. Zhang Yuye, Yan Weisheng "Research of Traffic Signal Light Intelligent Control System Based On Microcontroller" IEEE 2009
5. Manoj Kanta Mainali & Shingo Mabu (2010) "Evolutionary Approach for the Traffic Volume Estimation of Road Sections", pp100- 105, IEEE .
6. Cai Bai-gen, ShangGuan Wei, Wang Jian & Chen Rui (2009) "The Research and Realization of Vehicle Detection System Based on Wireless Magneto-resistive Sensor", Second International Conference on Intelligent Computation Technology and Automation, pp476- 479.
7. S. L. Toral, F. Barrero & M. Vargas (2008) "Development of an Embedded Vision based Vehicle Detection System using an ARM Video Processor", 11th International IEEE Conference on Intelligent Transportation Systems Beijing, China, pp292- 297.
8. Cai Bai-gen, ShangGuan Wei, Wang Jian and Chen Rui "The Research and Realization of Vehicle Detection System Based on Wireless Magneto-resistive Sensor" IEEE 2009. Second International Conference on Intelligent Computation Technology and Automation
9. Shilpa S. Chavan , Dr. R. S. Deshpande, J. G. Rana "Design Of Intelligent Traffic Light Controller Using Embedded System", Second International Conference on Emerging Trends in Engineering and Technology, ICETET-09
10. "Traffic Signal Optimization with Vehicles Queue and the Number of Pedestrians Non-complying at Single Intersection", 2008 Workshop on Power Electronics and Intelligent Transportation System.
11. Ahmed S. Salama, Bahaa K. Saleh, Mohamad M. Eassa "Intelligent Cross Road Traffic Management System", (ICRTMS), 2010 2nd International Conference on Computer Technology and Development (ICCTD 2010).