

# Pedestrian Detection for Driver assists Autonomous Vehicle Operation by Using CMOS Camera

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**Abstract**— Wireless sensor network based architecture is designed for the purpose of image transmission between two controlling units through CMOS camera. It is used to increase the data transmission speed. This project can be applied to any surveillance purpose. The protocol serial communication is used to transmit image accurately to the monitoring section. Image transmission with a combined robotic application is presented in this paper. For vehicle purpose, the path of the vehicle has to feed initially. This robotic section runs with LPC2148 with CMOS camera with RF transmitter and the other section with 8051 and RF receiver and monitoring section runs with MATLAB platform. Communications between two sections are accomplished through RF.

**Keywords**— ARM, RF, CMOS Camera

## I. INTRODUCTION

A self powered object tracking is been discussed in this project. A CMOS camera and ARM can do on-board image transmission, and these images are processed on MATLAB to localize vehicle and alert pedestrians. CMOS image sensors are rapidly becoming the technology of choice for digital imaging in mobile phones and other digital consumer portable products as they offer advantages in size, power consumption and system cost.

In this project, image transmission will be done with object tracking. The image transmission time is increased with the protocol standard. The Traffic signal section runs with CMOS Cam module and LPC2148 and monitoring unit runs on MATLAB platform. Communications between two units (hardware and PC) are accomplished through serial communication.

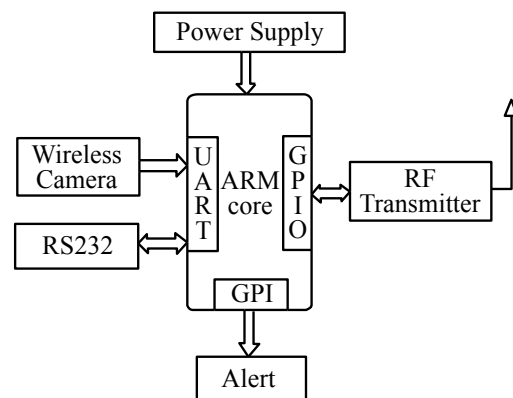


Fig. (a) ARM Processor of Signal section

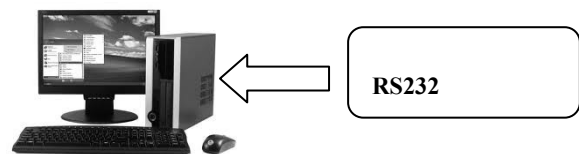


Fig. (b) Monitoring section

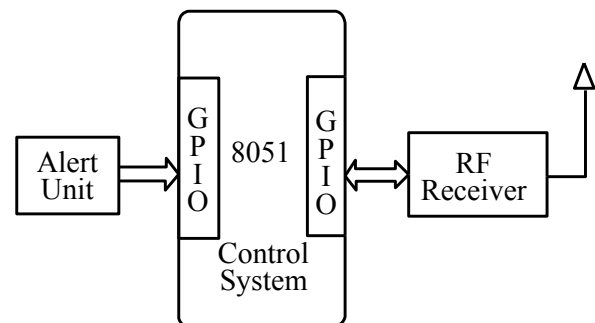


Fig. (c) 8051 section

## II. HARDWARE AND DESIGN

The ARM7TDMI core is the industry's most widely used 32-bit embedded RISC microprocessor solution. Optimized for cost and power-sensitive applications, the ARM7TDMI solution provides the low power consumption, small size, and high performance needed in portable, embedded applications.

The ARM7EJ-S processor is a synthesizable core that provides all the benefits of the ARM7TDMI – low power consumption, small size, and the thumb instruction set while also incorporating ARM's latest DSP extensions and Jazelle technology, enabling acceleration of java-based applications.

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Compatible with the ARM9, ARM9, and ARM10 families, and Strong-Arm architecture software written for the ARM7TDMI processor is 100% binary-compatible with other members of the ARM7 family and forwards-compatible with the ARM9, ARM9E, and ARM10 families, as well as products in Intel's Strong ARM and x-scale architectures.

#### A. ARM LPC2148 Microcontroller

**LPC2148 Microcontroller Architecture:** The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers (CISC). This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core.

Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory.

The ARM7TDMI-S processor also employs a unique architectural strategy known as Thumb, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue. The key idea behind Thumb is that of a super-reduced instruction set.

The ARM7TDMI-S processor has two instruction sets: The Thumb set's 16-bit instruction length allows it to approach twice the density of standard ARM code while retaining most of the ARM's performance advantage over a traditional 16-bit processor using 16-bit registers. This is possible because Thumb code operates on the same 32-bit register set as ARM code. Thumb code is able to provide up to 65% of the code size of ARM, and 160% of the performance of an equivalent ARM processor connected to a 16-bit memory system.

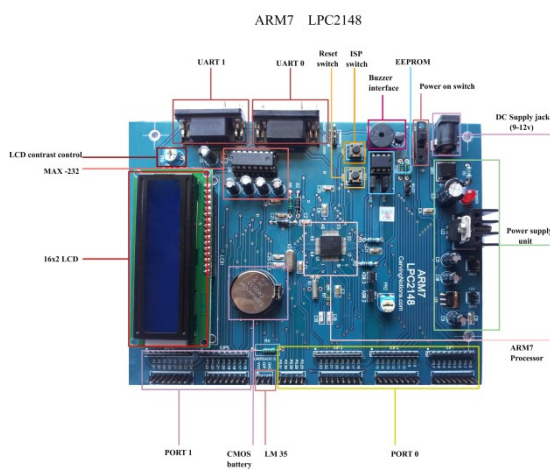


Fig.(d) LPC2148 Microcontroller

#### B. 8051 Microcontroller

Microcontrollers are now a day's silent workers in many apparatus, ranging from washing machine to video recorders. Nearly all of these controllers are mask

programmed and therefore are of very little use for applications that require the programs to be changed during the course of execution.

Even if the programs are altered, the information necessary to do so an instruction set, an assembler language and description for the basic hardware is either very difficult to obtain or inadequate when it came to the issue of accessibility. A marked exception to the above category is Atmel 89C51 microcontroller belonging to the Atmel family. This microcontroller has features that seem to make it more accessible than any other single chip microcontroller with a reasonable price tag.

The main controlling unit of the proposed system is the microcontroller. The main features of microcontroller and particularly Atmel 89C51 is discussed here. A microcontroller consists of a powerful CPU tightly coupled with memory [RAM, ROM or EPROM], various I/O features such as serial ports, parallel ports, timer/counters, interrupt controller, data requisition interface, Analog to digital converter [ADC], digital to analog converter, everything integrated into a single silicon chip.

It does not mean that any microcontroller should have all the above said features on a single chip, depending on the need and area of application for which it is designed, the on chip features present in it may or may not include all the individual section said above. Any microcomputer systems requires memory to store a sequence of instructions making up a program, parallel port or serial port for communicating with an external system timer/counter for control purpose like generating time delay.

### III. DESCRIPTION

The AT89C51 is a low-power, high performance CMOS 8 – bit microcomputer with 4 Kbytes of flash Erasable and Programmable Read Only Memory (EPROM). The device is manufactured using an Atmel's high-density nonvolatile memory technology and is compatible with the industry standard MCS-51tm instruction act and pin out. The on-chip flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with flash on a monolithic chip, the At89S51 is a powerful microcomputer, which provides a highly flexible and cost effective solution to many embedded control applications.

#### A. Features

- Compatible with MCS-51TH products.
- 4 Kbytes of in-system reprogram able flash memory.
- Fully static operation: 0 Hz to 24 MHz.
- Three-level program Memory Lock.
- 128\*8-Bit Internal RAM.
- 32 Programmable I/O Lines.
- Two 16-Bit Timer/Counters.
- Six Interrupt sources.

- Programmable serial channel.
- Low Power Idle and Power Down Modes 3.2 RF Module.

The RF Modules are Radio Frequency, any frequency within the electromagnetic spectrum associated with radio wave propagation. When an RF current is supplied to an antenna, an electromagnetic field is created that then is able to propagate through space. Many wireless technologies are based on RF field propagation.

The range of Radio Frequency is 10 kHz to 300 GHz. It can be used for wireless communication and also used generally to refer to the radio signal generated by the system transmitter, or to energy present from other sources that may be picked up by a wireless receiver.

- Wireless mouse, keyboard
- Wireless data communication
- Alarm and security systems
- Home Automation, Remote control
- Automotive Telemetry
- Intelligent sports equipment
- Handheld terminals, Data loggers
- High-end security and fire alarms

The TWS-434 extremely small, and are excellent for applications requiring short-range RF remote controls. The transmitter module is only 1/3 the size of a standard postage stamp, and can easily be placed inside a small plastic enclosure.

TWS-434: The transmitter output is up to 8mW at 433.92MHz with a range of approximately 400 foot (open area) outdoors. Indoors, the range is approximately 200 foot, and will go through most walls.

The TWS-434 transmitter accepts both linear and digital inputs can operate from 1.5 to 12 Volts-DC, and makes building a miniature hand-held RF transmitter very easy. The TWS-434 is approximately 1/3 the size of a standard postage stamp.

RWS-434: The receiver also operates at 433.92MHz, and has a sensitivity of 3uV. The WS-434 receiver operates from 4.5 to 5.5 volts-DC, and has both linear and digital outputs.

#### IV. INTRODUCTION TO MATLAB

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include

- Math and computation
- Algorithm development
- Data acquisition
- Modeling, simulation, and prototyping
- Data analysis, exploration, and visualization

- Scientific and engineering graphics

Application development, including graphical user interface building

MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. This allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar non interactive language such as C or FORTRAN. The name MATLAB stands for matrix laboratory. MATLAB was originally written to provide easy access to matrix software developed by the LINPACK and EISPACK projects. Today, MATLAB engines incorporate the LAPACK and BLAS libraries, embedding the state of the art in software for matrix computation. MATLAB has evolved over a period of years with input from many users.

In university environments, it is the standard instructional tool for introductory and advanced courses in mathematics, engineering, and science. In industry, MATLAB is the tool of choice for high-productivity research, development, and analysis. MATLAB features a family of add-on application-specific solutions called toolboxes. Very important to most uses of MATLAB, toolboxes allow you to learn and apply specialized technology. Toolboxes are comprehensive collections of MATLAB functions (M – files) that extend the MATLAB environment to solve particular classes of problems. Areas in which toolboxes are available include signal processing, control systems, neural networks, fuzzy logic, wavelets, simulation, and many others.

##### A. The MATLAB system

The MATLAB system consists of five main parts

##### 1. Development Environment

This is the set of tools and facilities that help you use MATLAB functions and files. Many of these tools are graphical user interfaces. It includes the MATLAB desktop and command window, a command history, an editor and debugger, and browsers for viewing help, the workspace, files, and the search path.

##### 2. The MATLAB Mathematical Function Library

This is a vast collection of computational algorithms ranging from elementary functions, like sum, sine, cosine, and complex arithmetic, to more sophisticated functions like matrix inverse, matrix Eigen values, Bessel functions, and fast Fourier transforms.

##### 3. The MATLAB Language

This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented programming features. It allows both “programming in the small” to rapidly create quick and dirty throw-away programs, and “programming in the large” to create large and complex application programs.

##### 4. Graphics

MATLAB has extensive facilities for displaying vectors and matrices as graphs, as well as annotating and printing these graphs. It includes high-level functions for two-dimensional and three-dimensional data visualization, image processing, animation, and presentation graphics. It also includes low-level functions that allow you to fully

customize the appearance of graphics as well as to build complete graphical user interfaces on your MATLAB applications.

#### 5. The MATLAB Application Program Interface (API)

This is a library that allows you to write C and FORTRAN programs that interact with MATLAB. It includes facilities for calling routines from MATLAB (dynamic linking), calling MATLAB as a computational engine, and for reading and writing MAT-files.

Various toolboxes are there in MATLAB for computing recognition techniques, but we are using IMAGE PROCESSING toolbox.

### V. CMOS CAMERA

The  $\mu$ CAM (micro CAM) is a highly integrated serial camera module which can be attached to any host system that requires a video camera or a JPEG compressed still camera for embedded imaging applications.

The module uses an Omni Vision CMOS VGA colour sensor along with a JPEG compression chip that provides a low cost and low powered camera system. The module has an on-board serial interface (TTL or RS232) that is suitable for a direct connection to any host micro-controller UART or a PC system COM port.

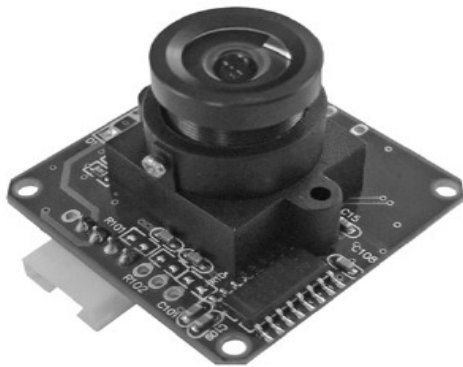


Fig.(e) CMOS Camera.

User commands are sent using a simple serial protocol that can instruct the camera to send low resolution (160x120 or 80x60) single frame raw images for a quick viewing or high resolution (640x480 or 320x240) JPEG images for storage or viewing.

The  $\mu$ CAM comes in a compact form factor with a built in lens and a 4-wire connector that provides easy access to both power and serial data. Small size, low cost and low powered camera module for embedded imaging applications. The features are,

- $\mu$ CAM-TTL: 3.3V DC Supply
- $\mu$ CAM-232: 5.0V DC Supply
- On-board EEPROM provides a command-based interface to external host via TTL or RS-232 serial link.
- UART: up to 1.2Mbps for transferring JPEG still pictures or raw images.
- On board Omni Vision OV7640/8 VGA colour sensor and JPEG CODEC for different resolutions.

- Built-in down sampling, clamping and
- Windowing circuits for VGA, QVGA, 160x120 or 80x60 image resolutions.
- Built-in colour conversion circuits for 2-bit gray, 4-bit gray, 8-bit gray, 12-bit RGB, 16-bit RGB or standard JPEG preview images.
- No external DRAM required.
- Weight ~11g.

### VI. CONCLUSIONS

In this project, image transmission will be done with object tracking. The image transmission time is increased with the protocol standard. The Traffic signal section runs with CMOS Cam module and LPC2148 and monitoring unit runs on Matlab platform. Communications between two units hardware and PC are accomplished through serial communication.

Camera attached to the Processor will continuously track the vehicle and pedestrians on the X-road region. If any vehicle and pedestrians are detected then automatically interrupt handling technique in the processor will receive the image and it will convert the image in to packets and transmit through serial communication. The monitoring section receives the image and converts the pixel values into image by using Matlab platform. Using an RF transmitter module the alert signal will be send to the vehicle. Similarly the buzzer on street will also blow to alert pedestrians.

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