Design of a Ploughing Vehicle Using Microcontroller

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Abstract—In today's technically advanced world, autonomous systems are gaining rapid popularity. The goal of this project was to develop a ploughing vehicle usually like tractors used to plough a field and it can be controlled automatically or manually through PC. This vehicle has a combination of wireless camera integrate in such a way, so as to provide simultaneous data acquisition and data transmission to the remote user through a RF transceiver.

Keywords—Wireless camera, AV Receiver, Motors, Microcontroller, RF Transceiver

I. INTRODUCTION

Autonomous vehicles have numerous applications. These vehicles can be used for object detection and avoidance. Ploughing is a method which is used to separate the soil on the surface and bring fresh nutrients to the surface. Before each crop to be planted in the agricultural field, the farmers will plough their field using different techniques like mouldboard plough and nowadays especially using tractors. In daily life, tractors are used to plough a field before a crop has planted in the field. The global focus of this paper to design a vehicle that will be plough the field by using dc motors connected to the ploughing device to lift up and down the plougher As the tractor will plough the field using plougher which is of more than 100kgs,but as the dc gear motors motors connected to the vehicle will not be able to lift up more than ½ kg ,a plougher prototype connected to the automatic vehicle to plough the field and the farmer can remotely monitor the ploughing action in PC through a wireless camera and AV receiver. The ploughing vehicle can be manually controlled as well as automatic operation can be done on the PC through keyboard keys. The RF Transceiver is used to transmit the commands from the PC through serial communication and used to receive the commands in the ploughing vehicle to move in a particular direction according to the commands sent from the farmer through PC.

II. HARDWARE IMPLEMENTATION

The block diagram of the hardware implementation of the entire system is as shown in the Figure1and 2. This Vehicle is radio operated, self-powered and has all the controls like a normal car. A motor has been connected to it, so that it can lift up and down the ploughing device when required. Wireless camera will send real time video and audio signals, which could be seen on a remote monitor, and action can be taken accordingly

Heart of our robot is ARM7 (LPC2129). Microcontroller acts as master controller decodes all the commands received from the transmitter and give commands to motor driver and also generating PWM pulses for the speed control. Based on the input codes master will give command to slave microcontroller and robot will behave as follows.

- ➢ moves in forward direction
- ➢ moves in reverse direction,
- ➢ speed controls in both the direction
- ➢ it can even turn left or right while moving forward or in reverse direction.
- ➢ Instant reverse or forward running without stopping.

A. Transmitting unit

Here a variable frequency oscillator1 is used for modulating the frequency i.e. to be transmitted and has its output thigh
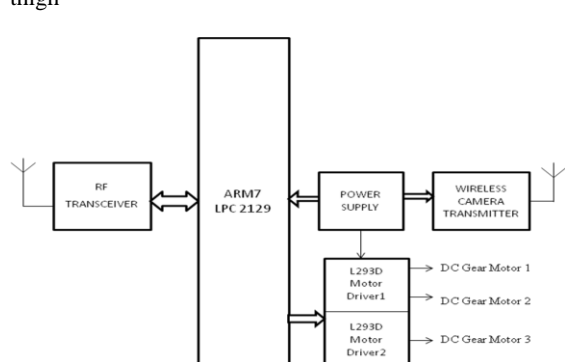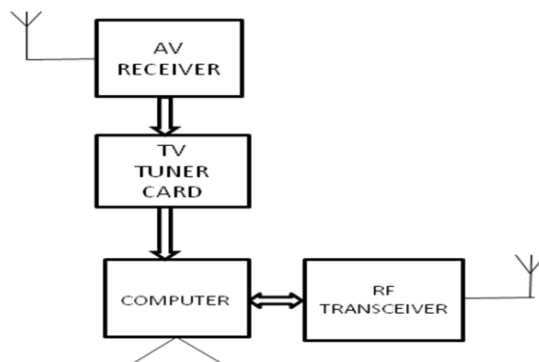

Fig1: Diagram of Vehicle Controller Circuit

Fig2: Block Diagram of PC Control Unit

frequency oscillator 2 for generating a carrier wave. The carrier wave is then radiated into space by the antenna. The farmer sends the commands to the ploughing vehicle using the PC through RF Transceiver and the AV receiver is used to receive the video of the ploughing vehicle direction .To display the video on the computer, a video capture card placed in PCI slots of CPU.

B. Receiving Unit

The receiving antenna is connected to a tuned wave detecting circuit for detecting the waves transmitted by transmitter antenna. The output of the tuned wave detecting circuit is connected to amplifier which in turn has its output connected to the input of the high pass frequency as well as the filter to a low pass frequency filter.

The received signals from the RF Transceiver are sent to the microcontroller. According to the commands received from the farmer ,the microcontroller gives the inputs to the motor driver to make move of dc gear motors connected to ploughing vehicle in a particular direction. The wireless camera which is separated from the microcontroller mounted on the vehicle to capture the video, where the vehicle is going. The AV receiver module is shown in Figure 3.

III.   HARDWARE RESOURCES

A. Power supply circuit

The main building block of any electronic system is the power supply to provide required power for their operation. For the LPC 2129 microcontroller. The LPC means Low Power Consumption which has on –chip regulators which provide 1.8V, 3.3V &5V. +1.8V is required for core CPU +3.3V for on-chip Peripherals + 5V for input –output devices. The wireless camera and AV receiver requires 9V supply and it can be provided through rechargeable battery

B. CC2500 RF Transceiver

The CC2500 is a low-cost 2.4 GHz transceiver designed for very low-power wireless applications. The RF transceiver is integrated with a highly configurable baseband modem. The modem supports data rate up to 500k Baud. This transceiver is intended for the 2400-2483.5 MHZ ISM (Industrial, Scientific and Medical) and SRD (Short Range Device) frequency band**.** It has low current consumption of RX: 13.3mA, TX: 21.2mA and operating at voltage 1.8 to 3.6V.

C. Motor Driver L293D

The Device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads and switching power transistors. To simplify use as two bridges each pair of channels is equipped with an enable input.

A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp diodes are included. This device is suitable for use in switching applications at frequencies up to 5 kHz. The L293D is assembled in a 16 lead plastic package which has 4 center pins connected together and used for heat sinking. The chip is designed to control 2 DC motors. There are 2 Input and 2 output pins for each motor.

D. Brushed DC Gear Motors

It is usually the motor of choice for the majority of torque control and variable speed applications .For the movement of our ploughing vehicle, we are using DC motors. It is operated by 9VDC power supply. In any electric motor, operation is based on simple electromagnetism. A current carrying conductor generates a magnetic field; when and to the strength of the external magnetic field.

E.UART

A Universal Asynchronous Receiver /Transmitter, abbreviated UART is a type of "asynchronous receiver-transmitter", a piece of computer hardware that translates data between parallel and serial forms. UARTs are commonly used in conjunction with communication standards such as EIA,RS-232,RS-422,RS-485. The Universal Asynchronous Receiver/ Transmitter (UART) takes bytes of data and transmits the individual bits in a sequential fashion. At the destination, a second UART re-assembles the bits into complete bytes. Each UART contains a shift register, which is the fundamental method of conversion between serial and parallel forms. Serial transmission of digital information (bits) through a single wire or other medium is much more cost effective than parallel transmission through multiple wires

F. RF Communication

Radio frequency (RF) is a rate of oscillation in the range of about 3 kHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals. RF usually refers to electrical rather than mechanical oscillations. The energy in an RF current can radiate off a conductor into space as electromagnetic waves (radio waves); this is the basis of radio technology.

G. JMK AV Receiver with Wireless Camera

It is mini wireless monitoring video camera and wireless receiver set for home and small business surveillance and is used here for demonstration purpose. Simply install the wireless camera in the ploughing vehicle where we want to

monitor and set the wireless receiver in the place (up to 15 meters away) and hook it up to a PC to watch the ploughing action.

H. TV Capture card

A TV capture card is a computer component that allows television signals to be received by a computer. It is a kind of television tuner. Most TV tuners also function as video capture cards, allowing them to record television programs onto a hard disk. Digital TV tuner card is as shown in the Figure

Figure 3: AV Receiver and Wireless Camera

The card contains a tuner and an analog-to-digital converter along with demodulation and interface logic.

Figure 4: ATI digital TV capture card

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IV. SOFTWARE IMPLEMENTATION

For the software implementation, we deploy two software packages. First one is the Keil µVision 3.0. second one is the Flash magic simulator. The Keil µVision Debugger accurately simulates on-chip peripherals (I²C, CAN, UART, SPI, Interrupts, I/O Ports, A/D Converter, D/A Converter, and PWM Modules) of ARM7device Simulation helps to understand hardware configurations and avoids time wasted on setup problems. With simulation, we can write and test applications before target hardware is available. The system program written in embedded C using KEIL IDE software will be stored in Microcontroller. Keil development tools for the Microcontroller Architecture support every level of software developer from the professional applications engineer to the student for learning about embedded software development. The industry-standard Keil C Compilers, Macro Assemblers, Debuggers, Real-time Kernels, Single-board Computers, and Emulators support all ARM7 derivatives. The Keil Development Tools are designed to solve the complex problems facing embedded software developers. Flash magic is used to dump the code to microcontroller from PC. Flash Magic is a free, powerful, feature-rich Windows application that allows easy programming of Philips FLASH Microcontrollers. Build custom applications for Philips Microcontrollers on the Flash Magic platform! Use it to create custom end-user firmware programming applications, or generate an in-house production line programming tool.The Flash Memory In-System Programmer is a tool that runs under Windows 95/98/NT4/2K. It allows in-circuit programming of FLASH memories via a serial RS232 link. Computer side software called Flash Magic is executed that accepts the Intel HEX format file generated from compiler Keil to be sent to target microcontroller. It detects the hardware connected to the serial port.

V. RESULTS

The ploughing vehicle on the field is shown in Fig 5 and finally the farmer can give the commands to the vehicle to move in a particular direction and the video where the vehicle is going is shown in Fig 6

Figure 5: Ploughing vehicle on Field

Fig 6: Video from the remote vehicle

VI. CONCLUSION

As we all know, these days most of the farmers came to the cities leaving their fields in their home places because of water scarcity and cost payable for ploughing the fields for tractors, JCB'S etc It's our onus to take an initiative to design a model of an apt ploughing vehicle, so that the farmers who didn't know about driving the tractors , how to plough the field can also remotely control the ploughing vehicle through this ploughing device prototype and the ploughing can be done either automatically (or)manually. Through this project, we can develop more applications that will be interface to this ploughing vehicle

ACKNOWLEDGMENT

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