Radar based Missile Navigation

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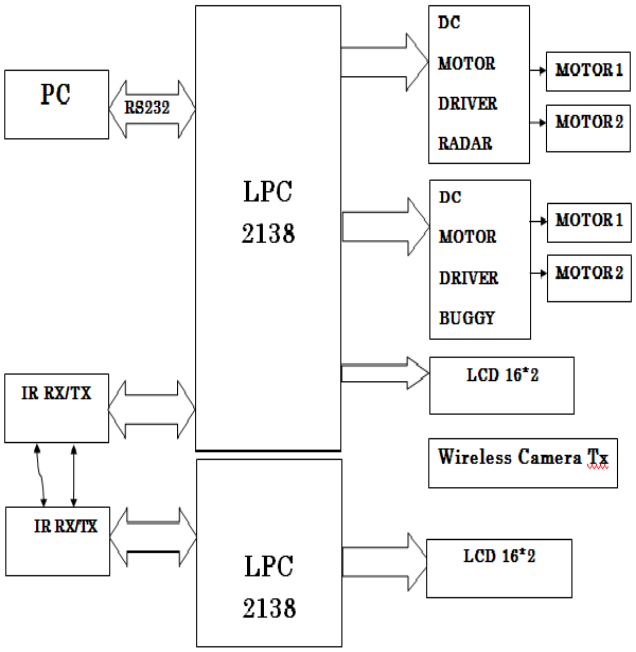
Abstract- In today's world enemy's warfare is an important factor in any nation's security. The national security mainly depends on Army (ground), Navy (sea), Air Force (air).The important and vital role is played by the army's artillery such as scud missile, bo - force guns etc. The main objective is to send the coordinates of the target to the gun. There are 2 types of coordinates that we are sending. One is the longitude and latitude of the missile and secondly the X & Y coordinates of missile. In our project we have come up with an idea of detecting the incoming buggy whether it is enemy or friendly with the help of higher encryption and decryption routine using some wireless protocol.

Keywords:-Microprocessor LPC2138, RC4 algorithm,RS232, MAX232, Regulator LM317, ultrasonic sensors.

I. INTRODUCTION

The project aims in designing a War field robot which is capable of detecting any obstacle (enemy or friendly unit) in its path using radar which is wirelessly controlled through PC using RF technology and the live images of the war field can be seen on the TV. It is a very low cost robot used to monitor the Warfield. The robot can be moved in all the directions using the PC wirelessly. The controlling device of the whole system is a Microcontroller. Whenever the user presses a button in the PC, the data related to that button is sent through RF module interfaced to PC. This data will be received by the RF module in the robot system and feds this to Microcontroller which judges the relevant task to the information received and acts accordingly. The live images from the camera in the robot system can be sent to TV through AV system. The Microcontrollers used in the project are programmed using Embedded C language. This project utilizes two DC Motors respectively. The DC motor generates torque directly from DC power supplied to the motor by using internal commutation, stationary permanent magnets, and Rotating electrical magnets. Advantages of a brushed DC motor include low initial cost, high reliability, and simple control of motor speed. Disadvantages are high maintenance and low life-span for high intensity uses. The driver used for DC Motors is 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 (such as relays solenoids, DC and stepping motors) and switching power transistors. This project makes use of a micro controller, which is programmed, with the help of embedded C instructions. This Microcontroller is capable of communicating with input and output modules. The controller is interfaced with dc motors, which are fixed to the Robot to control the direction of the Robot.

II. BLOCK DIAGRAM



III. BLOCK DIAGRAM EXPLANATION

A. Robot Unit

Here we start the robot and initialize LCD. Then move the tank based radar forward unit by 10 cm and then we stop tank unit. Move the Radar Unit by 360 degrees (32 steps of 11 degree each). Display the RADAR readings on Visual Basic software. Then we determine whether the obstacle has passed the set range. If yes, then we stop the radar and send an Encrypted frame to Friendly unit over IR trans-receiver. We wait for 5 seconds for decrypted frame and if the decrypted frame is received then no action is taken but if the frame is not received it means the enemy is detected and the signals are send to launch missile. The main objective is to send the coordinates of the target to the missile. There are 2 types of coordinates that we are sending. One is the longitude and latitude of the missile and secondly the X & Y coordinates of missile. In our project we have come up with an idea of detecting the incoming buggy whether it is enemy or friendly with the help of higher encryption and decryption routine using some wireless protocol.

B. Friendly Unit

The main function of this unit is to decrypt the signals received and send them back to the buggy. The signal frame is received and is stored in µC RAM and the decryption of the frame using RC4 algorithm is processed then the same frame is transmitted to tank via IR trans-receiver.

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If this is not done or the friendly unit fails to decrypt the frame it is considered as enemy and orders are generated by robot to destroy it by launching a missile.

IV. SPECIFICATIONS

A. Microcontroller LPC 2138

The LPC2131/32/34/36/38 microcontrollers are based on a 16/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine the micro controller with 32 kB, 64 kB, 128 kB, 256 kB and 512 kB of embedded high-speed flash memory. A128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at maximum clock rate. For critical code size applications, thealternative16-bitThumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, these microcontrollers are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. With a wide range of serial communications interfaces and on-chip SRAM options of 8 kB, 16 kB, and 32 kB, they are very well suited for communication gateways and protocol converters, soft modems, voice recognition and low-end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual10-bit 8-channel ADC(s), 10-bit DAC, PWM channels and 47 GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers particularly suitable for industrial control and medical systems.

B. RS 232

RS 232 IC is a driver IC to convert the µC TTL logic(0-5) to the RS 232 logic (+-9v).Many device today work on RS 232 logic such as PC, GSM modem , GPS etc. . .so in order to communicate with such devices we have to bring the logic levels to the 232 logic (+/-9v). Here as we can see the RS 232 chips have 2 pairs of TTL and 232 logic viz,

Pair 1: Pin 7, 8,9,10 of RS 232

Pair 2: pin 11,12,13,14 of RS 232

We can use any one pair in our project either 7, 8,9,10 pair or 11,12,13,14 pair. If we require 2 serial ports then Depending on the requirement of the project we may have to use both the pair in the same project. The µC works on TTL logic (0-5 v).So to convert the TTL logic to 232 logic we use the 4 capacitors connected to the RS232 IC. These capacitors are called charge pumps used to convert the TTL voltage to the +/- 9 v swing required by the 232 IC.

C. DC Motor

DC motors are used to physically drive the application as per the requirement provided in software. The dc motor works on 12v. To drive a dc motor, we need a dc motor driver called L293D. This dc motor driver is capable of driving 2 dc motors at a time. In order to protect the dc motor from a back EMF generated by the dc motor while changing the direction of rotation, the dc motor driver have an internal protection suit. We can also provide the back EMF protection suit by connecting 4 diode configurations across each dc motor. Here in our project we are using a 12v DC motor which is Bipolar, which means that the DC motor can rotate both the sides .For this we are using a DC motor driver IC L293D.This driver IC can drive 2 DC motor. In our project we are connecting only 1 DC motor so we are connecting only the 1st pair of the DC motor (in1 and in2 of L293D).The DC motor will be connected at OUT1 and OUT2 of L293D respectively.

D. RC4 Algorithm

The RC4 encryption algorithm was developed by Ronald Rivets of RSA. The RC4 algorithm is used identically for encryption and decryption as the data stream is simply XORed with the generated key sequence. The algorithm is serial as it requires successive exchanges of state entries based on the key sequence. Hence implementations can be very computationally intensive. This algorithm has been released to the public and is implemented by many programmers. This encryption algorithm is used by standards such as IEEE 802.11 within WEP (Wireless Encryption Protocol) using a 40 and 128-bit keys. Published procedures exist for cracking the security measures as implemented in WEP.

E. MAX232

The MAX220–MAX249 family of line drivers/receivers is intended for all EIA/TIA-232E and V.28/V.24 communications interfaces, particularly applications where ±12V is not available. These parts are especially useful in battery-powered systems, since their low-power shutdown mode reduces power dissipation to less than 5µW. The MAX225, MAX233, MAX235, and MAX245/MAX246/MAX247 use no external components and are recommended for applications where printed circuit board space is critical.

F. Regulators

The **LM317** is a popular adjustable linear voltage regulator. It was invented by Robert C. Dobkin and Robert J. Widlar in 1970 while they worked at National Semiconductor. As linear regulators, the LM317 and LM337 are used in DC to DC converter applications. Linear regulators inherently draw as much current as they supply. When this current is multiplied by the voltage difference between input and output, a significant amount of power is wasted as heat. This is not just inefficient, but a significant design consideration; a heat sink is commonly required. For large voltage differences, the wasted power can be more than the power supplied. This trade-off must be accepted when using linear regulators, which are a simple way to provide a stable voltage with few additional components. The alternative is to use a switching voltage regulator, which is usually more efficient, but tends to take up more space and require a higher component count.In packages with a heat-dissipating mounting tab, such as TO-220, the tab is connected internally to the output pin, which may make it necessary to electrically isolate the tab or the heat sink from other parts of the application circuit. The LM317 has three pins: Input, output, and adjustment. The device is conceptually an op amp (with a relatively high output current capacity). The inverting input of the amp is the adjustment pin, while the non-inverting input is set by an internal band gap voltage reference which produces,

a stable reference voltage of 1.25 V. A resistive voltage divider between the output and ground configures the op amp as a non-inverting amplifier so that the voltage of the output pin is continuously adjusted to be a fixed amount, the reference voltage, above that of the adjustment pin. Ideally, this makes the output voltage:

$V_{out} = V_{ref} (1 + R_L/R_H)$

Attribute	Value
V_{out} range	1.25 V – 37 V
$V_{in} – V_{out}$ difference	3 V – 40 V
Operation ambient temperature	0 °C – 125 °C
Output I_{max}	1.5 A (with proper heat sinking)
Minimum Load Current	3.5 mA typical, 12 mA maximum

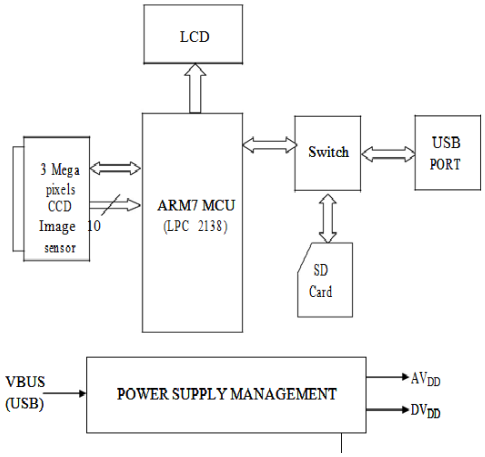
G. Ultrasonic Sensor (tr40-10)

Ultrasonic sensors are basically used to measure the distances between the obstacle / object and the sensor. The ultrasonic sensor works on Doppler Effect. It consists of a ultrasonic transmitter and a receiver. The transmitter transmits the signal in one direction. This transmitted signal is then reflected back by the obstacle and received by the receiver. So the total time taken by the signal to get transmitted and to received back will be used to calculate the distance between the ultrasonic sensor and the obstacle.

V. CAMERA INTERFACING

The report explains how a raw image data is captured by a CCD sensor and interfacing of the sensor with an ARM7 processor. It also discusses about the power management unit which supplies the power to the whole unit through a rechargeable Li-ion battery which is recharged through the USB port of the computer. The system works on a crystal frequency of 14.7456 MHz. The ARM processor works on a core frequency of 55.296 MHz and the peripheral frequency of 13.824 MHz. The CCD used, has a reconfigurable window sizes with smallest possible window as 400X96 pixels and largest possible window as 2048X1536. Presently the image in raw form with largest possible window size is acquired through the USB port of the computer.

A. Block Diagram of Camera Interfacing



VI. MISSILE GUIDE

In a modern military usage, a **missile**, or **guided missile**, is a self-propelled guided weapon system, as opposed to an unguided self-propelled munitions, referred to as just a rocket. Missiles have four system components: targeting and/or guidance, flight system, engine, and warhead. Missiles come in types adapted for different purposes: surface-to-surface and air-to-surface missile (ballistic, cruise, anti-ship, anti-tank, etc.), surface-to-air missiles (anti-aircraft and anti-ballistic), air-to-air missiles, and anti-satellite missiles. All known existing missiles are designed to be propelled during powered flight by chemical reactions inside a rocket engine, jet engine, or other type of engine. Non-self-propelled airborne explosive devices are generally referred to as shells and usually have a shorter range than missiles. Missiles are generally categorized by their launch platform and intended target. In broadest terms, these will either be surface (ground or water) or air, and then sub-categorized by range and the exact target type (such as anti-tank or anti-ship). Many weapons are designed to be launched from both surface or the air, and a few are designed to attack either surface or air targets (such as the ADATS missile). Most weapons require some modification in order to be launched from the air or surface, such as adding boosters to the surface-launched version. In military usage, munitions projected towards a target are broadly categorised as follows:

- A powered, guided munition that travels through the air or space is known as a missile (or guided missile.)
- A powered, unguided munition is known as a rocket.
- Unpowered munitions not fired from a gun are called bombs whether guided or not; unpowered, guided munitions are known as guided bombs or "smart bombs".
- Munitions that are fired from a gun are known as projectiles whether guided or not. If explosive they are known more specifically as shells or mortar bombs.
- A Powered munitions that travel through water are called torpedoes (an older usage includes fixed torpedoes, which might today be called mines).
- Hand grenades are not usually classed as missiles.

Guided missiles have a number of different system components:

- Targeting and/or guidance
- Flight system
- Engine
- Warhead

A. Guided System

Missiles may be targeted in a number of ways. The most common method is to use some form of radiation, such as infrared, lasers or radio waves, to guide the missile onto its target. This radiation may emanate from the target (such as the heat of an engine or the radio waves from an enemy radar), it may be provided by the missile itself (such as a radar) or it may be provided by a friendly third party (such as the radar of the launch vehicle/platform,

or a laser designator operated by friendly infantry). The first two are often known as fire-and-forget as they need no further support or control from the launch vehicle/platform in order to function. Another method is to use a TV camera—using eithervisible light or infra-red—in order to see the target. The picture may be used either by a human operator who steers the missile onto its target, or by a computer doing much the same job. One of the more bizarre guidance methods instead used a pigeon to steer the missile to its target. Many missiles use a combination of two or more of the above methods, to improve accuracy and the chances of a successful engagement.

B. Engine

Missiles are powered by an engine, generally either a type of rocket or jet engine. Rockets are generally of the solid fuel type for ease of maintenance and fast deployment, although some larger ballistic missiles use liquid fuel rockets. Jet engines are generally used in cruise missiles, most commonly of the turbojet type, due to its relative simplicity and low frontal area. Turbofans and ramjets are the only other common forms of jet engine propulsion, although any type of engine could theoretically be used. Missiles often have multiple engine stages, particularly in those launched from the surface. These stages may all be of similar types or may include a mix of engine types - for example, surface-launched cruise missiles often have a rocket booster for launching and a jet engine for sustained flight. Some missiles may have additional propulsion from another source at launch; for example the V1 was launched by a catapult and the MGM-51 was fired out of a tank gun (using a smaller charge than would be used for a shell).

VII. ADVANTAGES

A. Less time delays.
B. Quick response.
C. Fully automate system
D. Robust system.
E. Low power consumption
F. Guidance systems improve missile accuracy by improving its "Single Shot Kill Probability" (SSKP), which is part of combat survivability calculations associated with salvo combat model.
G. The CLOS (Command Line-Of-Sight) system uses only the angular coordinates between the missile and the target to ensure the collision.
H. Target tracking, missile tracking and control are automatic.

VIII. CONCLUSION

The project radar based missile navigation system has been successfully designed and tested. It has been developed by integrating features of all the hardware components used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC's and with the help of growing technology the project has been successfully implemented.

IX. FUTURE SCOPE

In parallel with these efforts, we will achieve more delicate tasks of enhancement of operability by hardware and improvement of reliability of the communication system. It is currently obvious that this robot is required in the defence market. We are absolutely determined to proceed with further research and development efforts to commercialize the robot as soon as possible. The result of research and development activities war field robots is announced on a large scale one after another recently. Each of these events is highlighted dramatically. War field missile navigation system is undoubtedly a new, indispensable industry in the 21st century. Under these circumstances, the authors sincerely hope that their research efforts will contribute to the development of war field robots. Our aim is to discover the future abilities of war field missile navigation system by presenting a variety of integrated research in various scientific and engineering fields. For future development we can also interface zigbee for far distance. In this project we control this spy robot short distances 5Meters to 10Meters. Further development of this spy robot we extend the distance up to 5kilo meters by using of RF (Radio interface) frequencies.

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