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Missile Detection and Automatic Destroy System

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Abstract

This proposed system uses an ultrasonic module interfaced to a microcontroller of 8051 family. An ultrasonic transducer comprising of a transmitter and receiver are used. The transmitted waves are reflected back from the object and received by the transducer again. The total time taken from sending the waves to receiving it is calculated by taking into consideration the velocity of sound. Then the distance is calculated by a program running on the microcontroller and displayed on an liquid crystal display screen interfaced to the microcontroller through ZigBee Wireless communication.
The circuit is used to receive the reflected signals of 40 KHz from the missile object, to feed that to a program of the microcontroller and to switch on appropriate load while the program is executed at the microcontroller. When the microcontroller receives the signal from ultrasonic receiver it activates the door gun by triggering the gate of MOSFET through a transistor or relay. The sensor is fitted on antenna and is rotated and controlled by stepper motor through 360 degrees. If there is any target within the detection range, the application will turn the launcher to the nearest detected target and fires.

Index Terms: Microcontroller, Ultrasonic transducer. Zigbee. Stepper motor. DC gear motor.

1. Introduction

The proposed system uses an ultrasonic module interfaced to 8051family microcontroller to detect missile object. An ultrasonic transducer comprising of a transmitter and receiver are used on same module. The ultrasonic transducer produces sound waves. The transmitted sound waves are reflected back from the object and

received by the transducer again. The total time taken from sending the waves to receiving it is calculated by taking into consideration the velocity of sound. Then the distance is measured and displayed on a liquid crystal display interfaced to the microcontroller.

When the microcontroller receives the signal from ultrasonic receiver, it activates the door gun by triggering the gate of MOSFET through a transistor or relay. The sensor is fitted on antenna and is rotated and controlled by stepper motor through 360 degrees. If there is any target within the detection range, the application will turn the launcher to the nearest detected target and fires.

The antenna is rotated and controlled by stepper motor by one axis and also with another axis it rotates up and down directions towards missile object simultaneously[1]. The tank vehicle is fitted with another microcontroller for movements of the vehicle's control actions send and receive by the key panel through wireless zigbee communication. The programs for 8051 family microcontroller are written by the embedded C programming using kiel software.

2. Architecture of Proposed System

The architecture of proposed system is consists of 8-bit microcontrollers AT89C51and P89V51RD2, Zigbee wireless communication module, Ultrasonic Transducer module, Stepper motor drive module, geared DC motor drive module, LCD interface module and other necessary accessories. These are explained in subsections.

2.1 Microcontrollers

The missile detection and automatic destroyer system using 8-bit microcontrollers are shown in Figure1 Fig. 2. The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pinout. 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 Atmel AT89C51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution.

The AT89C51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, two 16-bit timer/counters, a five vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator and clock circuitry. In addition, the AT89C51 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer / counters, serial port and interrupt system to continue functioning. The Power-down Mode saves the RAM contents but freezes the oscillator disabling all other chip functions until the next hardware reset[3].

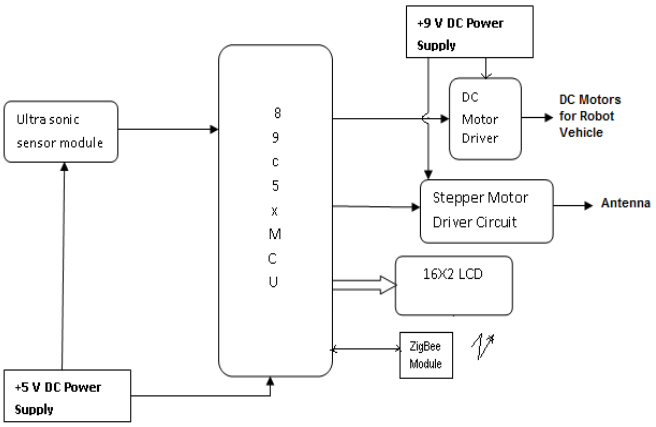

Fig. 1: Block Diagram of Microcontroller based Missile Object Detector.

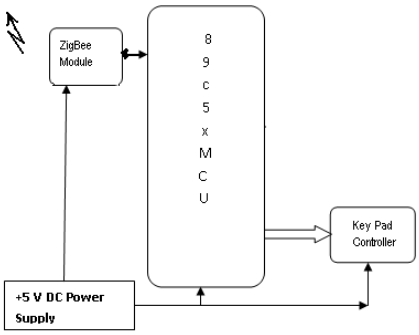

Fig. 2: Block Diagram of Microcontroller based Zigbee Wireless Key pad controller.

2.2 Ultrasonic Transducer

Ultrasonic sensors also known as transceivers work on a principle similar to radar or sonar which evaluates attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor is shown in Fig. 3. Use for motion or distance sensing with Frequency: 40kHz ±1.0kHz, Aluminum case, Capacitance: 2000Pf ±20% . The transmitter bandwidth is 5.0kHz/100Db and sound pressure level 112Db/40 ±1.0kHz.

Fig. 3: Ultrasonic Transducer Module.

An ultrasonic proximity sensor uses a piezoelectric transducer to send and detect sound waves. Transducer generate high frequency sound waves and evaluate the echo by the detector which is received back after reflecting off the target.

2.3 ZigBee Wireless Communication

ZigBee is the set of specs built around the IEEE 802.15.4 wireless protocol. The name "ZigBee" is derived from the erratic zigging patterns many bees make between flowers when collecting pollen. This is evocative of the invisible webs of connections existing in a fully wireless environment. The standard itself is regulated by a group known as the ZigBee Alliance, with over 150 members worldwide [4].

ZigBee devices are actively limited to a through-rate of 250Kbps, compared to Bluetooth's much larger pipeline of 1Mbps, operating on the 2.4 GHz ISM band, which is available throughout most of the world.

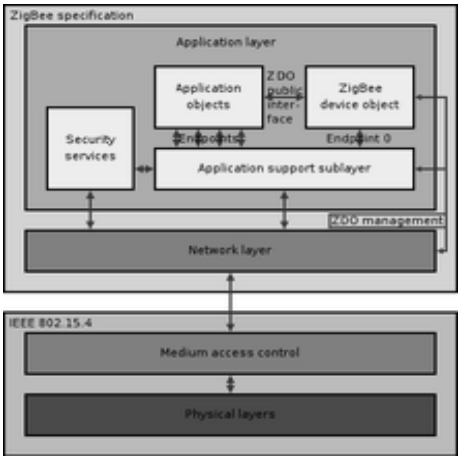

Fig. 4: Zigbee protocol stack.

Fig. 5: Zigbee hardware module.

ZigBee has been developed to meet the growing demand for capable wireless networking between numerous low-power devices. In industry ZigBee is being used for next generation automated manufacturing, with small transmitters in every device on the floor, allowing for communication between devices to a central computer. This new level of communication permits finely-tuned remote monitoring and manipulation.

3. Keil Software

The keil software provides with software development tools for the 8051 family of microcontrollers. Keil provides following tools for 8051 development such as C51 Optimizing C Cross Compiler, A51 Macro Assembler, 8051 Utilities (linker, object file converter, library manager), Source-Level Debugger/Simulator, µVision for Windows Integrated Development Environment [5].

3.1 Keil C Cross Compiler

Keil is a German based Software development company. It provides several development tools like, Integrated Development environment (IDE), Project Manager, Simulator, Debugger, C Cross Compiler, Cross Assembler, Locator/Linker.

4. Experimental Setup Testing

The experimental setup is tested is shown in Fig. 6. and verified by the operations shown in table 1. The experimental setup mainly works on autonomous standalone system with sequence of operations as per algorithm and programs executes through microcontrollers.

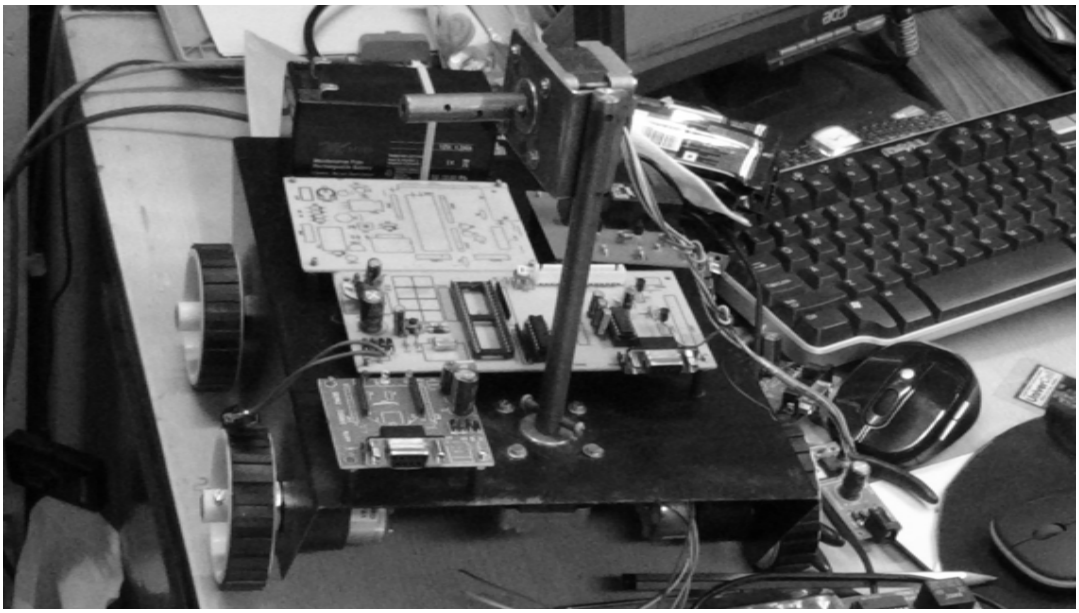

Fig. 6: Experimental Setup.

The table 1 is gives the experimental manual tested results and its successful operations.

Table 1

Sl. No.	Key Pad Controls	Control Actions	Operation & Results
1	Right	Vehicle Turn Right	Operates as desired
2	Left	Vehicle Turn left	Operates as desired
3	Stepper Right	Antenna rotates clockwise	As per microcontroller program
4	Stepper Left	Antenna with sensor rotes counter clockwise	As per microcontroller program
5	Stepper Up	Antenna with sensor rotates up	As per specified degree in program
6	Stepper Down	Antenna with sensor rotates down	As per specified degree in program
7	Fire	Relay with buzzer output	Destroys the missile object

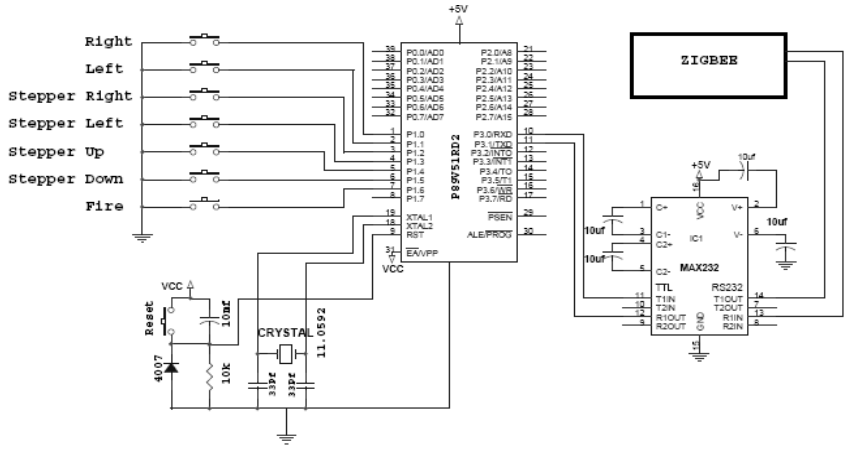

Fig. 7: Wireless Key pad controller with Zigbee interface.

5. Conclusion

The Ultrasonic transceiver (Transmitter & Receiver) detects missile object and displays distance on LCD through Microcontroller based Zigbee wireless communication standard. The sensor is fitted on antenna and is rotated and controlled by stepper motor through 360 degrees and also with up and down directions. If there is any target within the detection range, the application will turn the launcher to the nearest detected target and fires. The tank vehicle is fitted with another microcontroller with movements of the vehicle's control actions send and receive by the zigbee communication key panel. The launching system can be modified to aim at missile object in three axis rotation by following the Ultrasonic transceiver data.

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