Unmanned Robotic Ground Vehicle by Using ZIG-BEE and GPS

G. Viswanatha Reddy  
Department of ECE  
Kuppam Engineering College  
Kuppam-Andhra Pradesh

E. Venkatramana  
Associate Professor  
Department of ECE  
Kuppam Engineering College  
Kuppam-Andhra Pradesh

Dr. G. N. Kodanda Ramaiah  
HOD-Department of ECE  
Kuppam Engineering College  
Kuppam-Andhra Pradesh

Abstract—The pattern of this paper province comprises of a self-navigating robotic ground vehicle as a base on which guided by the computer in the control room as a surveillance system and the remote triggered for a weapon is fitted in the ground vehicle. The ARM7 Controller acts as a crucial scheming element for the ritual built vehicle. The ARM architecture describes a family of RISC-based COMPUTER PROCESSOR. The reduced complexity and simpler design build a low-energy system on chip for an embedded system incorporating memory, interfaces, radios, etc. The ground vehicle contains single board embedded system that is equipped with GPS and ZIG-BEE modems along with ARM processor, which in turns the GPS receiver has been interfaced with the vehicle which is capable of receiving information from the GPS satellites and this technology allows the system in finding out the location of the vehicle in terms of Latitude and longitude coordinates, anywhere on earth and provides most up to date information about ongoing trips. The control room can transmit the targeted location by ZIG-BEE technology to the ground vehicle in terms of Latitude and longitude data. Once the vehicle receives this data, the microcontroller unit compares the targeted location with the present location and separately moves to the desired location. The movement of vehicle is detected by the Passive IR sensor. Additionally the camera is mounted on the robotic ground vehicle, which is in a scanning pattern to capture all the visible details around the vehicle. The video is transmitted to a control room through ZIG-BEE module, if the presence on enemy is detected the mounted weapon on the vehicle is triggered based on the commands from the control room. The main purpose of this project is to provide following features a) Location information b) Real time tracking c) Communication is instantaneous therefore we can receive running report d) Completely integrated controlled and monitored by control room

Keywords—ARM7, GPS Receiver, PIR Sensor, Wireless Camera, Surveillance, ZIG-BEE, LASER GUN.

I. INTRODUCTION
Terrorism, the new face of nation’s fate has exceeded its own state of action. It’s time to uproot terrorism instead to face it and to dedicate the brave hearts to the nation. With the advent growth in the field of Robotics in today’s scenario is tremendous especially in the areas of nation’s security is concerned. As terrorism increasing day by day, its duty of engineer’s to curb it through innovation. Since robots become more advanced and sophisticated it can be used to perform the desired tasks where men cannot be in a state to carry out his tasks. With automation and application of electronics in the field of robotics ensures safety for individuals and desired task can be achieved. This paper set sights on devising and demonstrating an archetype of one guided weapon system which considerably reduces the people substantially present in the streaks of fire. The objective of our work is to devastate the terror
activities. In this paper, the methodology adopted to achieve our objective is to build a self-powered vehicle with self-navigating design; sensing obstacle in the navigation path of the vehicle; to turn ON the wireless camera once the vehicle movement is detected; to transmit the real time video signals to control room and to trigger the weapon if necessary.

II. BACKGROUND

There have been many bombings in Mumbai since the 13 coordinated bomb explosions that killed 257 people and injured 700 on 12 March 1993. On 6 December 2002, a blast in a BEST bus near Ghatkopar station killed two people and injured 28. A bicycle bomb exploded near the Vile Parle station in Mumbai, killing one person and injuring 25 on 27 January 2003. On 28 July and 25 August 2003, two bombs exploded in South Mumbai, one near the Gateway of India and the other at Zaveri Bazaar in Kalbadevi. At least 44 people were killed and 150 injured. On 11 July 2006, seven bombs exploded within 11 minutes on the Suburban Railway in Mumbai, 209 people were killed, including 22 foreigners and over 700 injured. The attacks are sometimes referred to in India as "26/11", after the date in 2008 that they began the attacks, and the nomenclature behind the 9/11 attacks in the United States, akin to that of the 3/11 attack in Madrid, Spain, and the 7/7 bombings in London, United Kingdom. It could have been avoided if any robotic force is used instead of the brave martyrs who lost their lives. The occurrence of terrorism serves as a background for the paper.

III. RELATED WORK

Most of the military organization now takes the help of robots to carry out many risky jobs that can’t be done by the soldier. ARV robots are more like tanks. In fact they are less like soldiers. These military robots are mainly used as support for manned vehicle missions. The commander of a tank squadron can use these robots without the need for more soldiers. The history of military robots during the time of World War II these robots were in the form of German Goliath tracked and Soviet teletanks. The history begins with the invention of radio controlled boat intended for military use by Nicola Tesla. Smart controlled robotic vehicles like QinetiQ’s MAARS are armed with weapons to shoot insurgents.

IV. DESIGN CONSIDERATIONS

The development of Unmanned Robotic Ground Vehicle was divided into three phrases. In first phrase, the vehicle module was instrumented. In second phrase, the computer control module was instrumented. In third phrase, a display unit is set up in the control room.

In the vehicle module section, the microcontroller ARM7 is the heart of the entire design. Its features includes 32-bit, 0-MHz, 32-bit ARM7TDMI-S with AHB/APB interfaces. And Very fast Flash programming via on-chip boot-loader software with Temperature range: -40 to +85 °C These powerful yet cost-effective microcontrollers have up to 512 KB of ISP/IAP Flash and up to 32 KB of SRAM. Each has up to two 10-bit A/D converters, two I2C-bus interfaces, and Fast I/o operations. Wide operating voltage range (2.0V to 5.5V). The GPS Receiver GMO-101 features include Full implementation of ultra-high performance SiRFstarIII single chip architecture. High tracking sensitivity of -159dBm; Low power consumption of 45mA at full tracking (for USB interface); Small size of 36(W)x42(L)x15(H) (mm) with patch antenna of 25x25x4mm.; Built-in backup battery for hot/warm starts and better performance; Firmware upgradeable for future potential performance enhancements and Flexible connector interface and cable length.

The PIR sensor features includes Detection range up to 20 feet away; Single bit output; Jumper selects single or continuous trigger output mode; 3-pin SIP header ready for breadboard or through hole project; Small size makes it easy to conceal; Compatible with BASIC Stamp, Propeller, and many other microcontrollers.

The computer control module circuit diagram is shown below. The AC source is used, which is fed to the transformer. From the transformer the AC voltage is fed to a rectifier circuit consisting of one or more diodes. The rectifier converts AC voltage to DC voltage. This DC is not steady as from a battery. The regulator circuit is used to give out a very steady voltage. The MAX232 is used which is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. To interface the hardware module to the computer, the RS232 port on the computer is used. The XBee transceiver with the following specifications is used, Indoor/Urban: up to 100’ (30 m); Outdoor line-of-sight: up to 300’ (100 m); Transmit Power: 1 mW (0 dBm); Receiver Sensitivity: -92
dBm; TX Current: 45 mA (at 3.3 V); RX Current: 50 mA (at 3.3 V); Power-down Current: < 10 µA.

Fig. 1  Circuitry of Robotic Vehicle Module

Fig. 2  Circuitry of Computer control module
V. SYSTEM DESCRIPTION

The commands for the action on the robotic vehicle to be performed are sent only from the control room. The control room module has a XBee transceiver which transmits the command window input to the vehicle. The command window is programmed by means of using Visual Basic 6.0 software.

As the vehicle power supply is turned on the GPS location of the vehicle is shown in command window in terms of Latitude and Longitude. The command window is programmed in a way to show the GPS location of the vehicle even while navigation. The latitude can be incremented or decremented by clicking on the respective icons on the command window. Similarly, the longitude can also be incremented or decremented by clicking on the icons on the command window for the respective navigation of the vehicle. As the desired location of the vehicle is reached, the message DESTINATION REACHED is popped up on the command window. If any kind of obstacle or intruder is detected the vehicle intimates the control room with message OBSTACLE DETECTED with the location of obstacle in terms of latitude and longitude. Two icons are provided on the command window to rotate the camera clockwise and anti-clockwise. An icon FIRE ON is provided to trigger the weapon if necessary. A receiver is kept on the control room to receive the video signals which is been transmitted from the wireless camera mounted on the vehicle. The receiver is connected to a display unit to view the real time video captured by the vehicle camera.

The IR LED proximity sensor is used in the system for the detection obstacle on the path of navigation. The Infrared proximity sensors work by sending out a beam of IR light, and then computing the distance to any nearby objects from characteristics of the returned (reflected) signal which is received by another IR LED. The XBee transceiver is placed on the vehicle which receives all the commands given from the control room. The heart of this vehicle is microcontroller ARM7 Two microcontrollers, IC2 is first microcontroller which acts as master controller which decodes all the commands received from the transmitter and give commands to slave microcontroller1 IC3 and slave2 IC5. Slave2 microcontroller controls the gun and camera movements in up/down, left or right direction. IC6 is driver IC which drives gun and camera motors in two angles. Slave microcontrollers are responsible for executing all the commands received from the master and also generating pulse width modulation pulses for the speed control.

The wireless camera is tuned on once the movement of the vehicle is detected. Wireless camera transmits a video and audio signal to a wireless receiver through a radio band. The images are continuously sent to the receiver display at the control room. The barrels are mounted on the vehicle which provides the passage for the bullets when fired, the storage of bullets will me in a chamber placed inside the vehicle. The barrel turret is capable to rotate its angle by an angle of 180 degrees. As the terrorists are being viewed on the receiver station display as the wireless camera transmits the digital signal the barrels will start to fire based on the commands from the server station.

VI. ALGORITHM FOR PROPOSED SYSTEM

STEP 01: Start
STEP 02: Latitude and Longitude data of the vehicle is transmitted to control room to indicate present location of vehicle.
STEP 03: PIR sensor checks the vehicle movement. STEP 04: If the movement is detected, Turn ON the Wireless camera.
STEP 05: Transmit the real-time video signals to control room.
STEP 06: Navigate the vehicle towards the desired location.
STEP 07: Location of the vehicle is updated while navigation.
STEP 08: Check for obstacle in the path of vehicle. STEP 09: If obstacle detected intimate the control room and take alternative path else navigate in the prescribed path.
STEP 10: Intimate the control room when the vehicle reached the target location.
STEP 11: If desired send commands to fire up using barrel turrets.

VII. EXPERIMENTAL RESULTS
The program for the control room operations has been carried out using Visual Basic 6.0 software. The visual programming aims at providing the user with an interface that is intuitive and easy to use. In developing such an interface, the programmer employs user-friendly features. The window shown below represents the program code for control room operations.

Fig. 3 Block Diagram of vehicle module section:

**VEHICLE MODULE:**

- SENSOR ARRAY
- GPS
- 12V BATTERY
- XBEE
- WIRELESS WEBCAM
- LPC2148 (ARM7)
- L293D
- DC MOTORS

Fig. 4 Screenshot of Program code for control room operations

Fig. 5 Screenshot of Microsoft Visual C++ program
Location of the vehicle are shown in the control room command window terms of latitude and longitude (GPS Locations). The desired location can be allocated by increasing or decreasing the latitude and longitude. The transmit tab is used to transfer the desired location to the robotic vehicle. Once the vehicle reaches the desired location a message indicating DESTINATION REACHED will be popped up on the command window. If an obstacle is been detected, a message OBSTACLE DETECTED will appear on the screen. to move the camera 360 degrees, respective tabs are used.

The computer in the control room is interfaced to the hardware module in the control room by means of using the USB Port. The XBee transmitter present in the control room module establishes a communication link between the robotic vehicle and the control room. The real time videos are transmitted to the control room by the wireless camera placed on the vehicle. A receiver is used in the control room to capture the signals which can be viewed on the display unit.
Fig. 7 Control room Transmitter module

Fig. 8 Video receiver unit at control room

Fig. 9 View of Internal circuitry of the prototype
VIII. FUTURE WORK

The purported system presents the versatile autonomous robotic ground vehicle with reconnaissance action. The vehicle is observed to be capable of navigating over rough terrain and the triggering action holds good. The potential scope to incorporate features with the present design of the vehicle encompasses methods like rapid hazard avoidance maneuver when operation of the vehicle is in the rough changing terrain to alter the speed in various situations, optical dynamic detection method for detecting the buried bomb materials around the vehicle environment and to mount a robotized arm on the vehicle to lift the suspicious object, thereby scanning it using portable x-ray device. The additional features to be incorporated with the present construction of the vehicle are highly promising.

IX. CONCLUSION

In this paper, the design and implementation of unmanned robotic ground vehicle has been depicted in detail and a minimum realization able to realistically demonstrate capability potential with the given mission is represented. The paper delivers an entirely novel technique for nullifying the terror activities inside the buildings. Furthermore, the proposed system has the capability of revolutionizing design of next generation defense weapon system. The test tasks were very much pertained to surveillance and tactical reconnaissance was satisfactory. The salient part of the whole system includes system integration and information flow between the control room and the robotic vehicle. The system level enables the task oriented operations that combines the autonomous motion of the robotic vehicle and task execution capabilities. The designed vehicle has the potentialities to uproot terrorism instead of facing it and it is dedicated to save brave hearts to the nation.

REFERENCES