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Wireless Communication Based High Speed Spy Bot

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***Abstract*—**The objective behind making this project deals out with satisfying various functional needs such as secretly spying or keeping surveillance over a desired target location. We also aim to achieve a few more additional comprehensive needs such as detection of gas, temperature sensing, camouaging feature and movement of bot. We have made our robot with an advantage of monitoring both audio and video parameters. The most eye catching feature of our bot is that it would be able to change its body colour that it treads along. We have achieved our main goal by aggregating individual robotic functions in a single robotic package. This bot can either be used for keeping an eye or a supervisory control function like a spy bot or with the additional features as that we have added to this robot could serve as an important unmanned vehicle which could actually combat with the opponents or enemies in the war _elds. Thus making it multifunctional, it could be used to serve more than one application areas. The camouaging feature of bot is solution for reducing human losses in military operations or terrorist attacks. This project is basically a step taken to save the human lives in the area where this bot is used.

Keywords— Spybot, ATmega328, Color Sensor, Zigbee, AVR 328P-PU.

I. INTRODUCTION

With the aim of developing a high-tech technology that serves high speed technology, advanced capacity to control the robots and device with new methods of control theory. To realize above standards some technical improvement along with the need of high performance robot is required to create a faster, reliable, accurate and more intelligent robot which can be devised by advanced control algorithm, robot control devices and new drivers. Earlier the robots were controlled through wired networks but now to make robot more user friendly, they are framed to do user commanded work. Robots can be controlled using wireless communication also. Therefore to attain the requirements we can use zigbee module, Bluetooth etc. to control the user friendly bot. A robot is a mechanical or virtual agent, usually an electro-mechanical machine that is guided by a computer program or electronic circuitry. Robots can be autonomous or semi-autonomous or they can be humanoids such as Honda's ASIMO. Merriam-Webster denes robot as a machine that looks like a human being and perform various complex acts; a device that automatically performs complicated, often repetitive tasks; a mechanism guided by automatic controls. ISO describes a robot as an automatically controlled reprogrammable, multipurpose manipulator programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications. Robots are making a considerable impact on many aspects of modern life, from industrial manufacturing to healthcare, transportation, and exploring deep space and sea. Tomorrow, robots will be as personal as todays personal computers. MRS is becoming most important areas of research in Robotics, due to the challenges involved in research and to the multiple potential applications to areas such as autonomous sensor networks, building surveillance, transportation of large objects, monitoring of air and underwater pollution , detection of forest _re, transportation systems, Even problems that can be handled by a single multi-skilled robot may bene_t from the alternative usage of a robot team, since robustness and reliability is increased by combination of several robots which are individually less robust and reliable. Research is going on to focus on smoothing the movements; however, speed is less important than the robots exibility. Soft robots are useful because they are resilient and can manoeuvre through very constrained spaces.The camouage-bots are covered in a network of tiny channels. As di_erent dyes are pumped in, the robots can quickly change their appearance. As well as changing colour,

hot or cold uids can be pumped into robots, enabling them to be thermally camouaged, and uorescent liquids allow them to glow in the dark. Currently, the uid is pulled in from a reservoir, but in the future it could be incorporated into the robot's body. Colour bots are a primitive form of botting that uses colours in the game to perform. It is done as the bot being told to recognise a certain type of colour on the screen and clicking on that colour. After a certain period of time, the colour has either disappeared or is then clicked again. More complex colour bots can scan certain images or 3D objects in game. After using the same strategy, it then moves to another location. These bots are unreliable and are mostly rendered temporarily useless if the colours or the graphics are changed. Jagex broke lots of these bots by changing the colour in the random events, although some colour bots can get around this by scanning the object instead of looking for a certain colour on screen. This poses a large challenge to these bots and their creators. For showing the camouaging feature in bot, we are going to use LED strips and colour sensor instead of uid mechanism. The bot can be controlled using wireless communication module Zigbee. In addition to make this system multifunctional,it also contains Gas sensor and Temperature sensor.

Robotics: A Paradigm Shift Robots play a major role in many walks of life and are extensively used in the areas of defence, industries, medical and home applications. They can carry out di_erent risky jobs that cannot be done by human. This paper presents Defence Surveillance robot (DSR) for defence purpose that has metal and magnetic _eld detection sensor, LDR sensor for night vision, _re detection sensor with pump motor to extinguish _re, IR sensors for path _nding and obstacle avoidance, moisture sensor. A robotic arm of 4 degree of freedom is interfaced for explosive placement and di_usion. The system provides continuous visual monitoring through the wireless camera attached to the robot and sends continuous data to the control unit. Basically three modes of operations are provided i.e. RF mode, DTMF mode and Automatic mode[6]. The recent upsurge in interest in autonomous robots for combat applications has focused considerable attention on several of the obvious technical issues (e.g. target recognition, autonomous navigation, route planning). However, several technical issues exist which remain unapproached and, in some cases, even unacknowledged by the robotics community. The Three issues related to robots are :

1. Robot fault tolerance
2. Robot security
3. Multi-robot coordination

These issues are discussed in terms of the technology limitations and the research issues associated with those limitations. A common message which occurs several times during discussion denotes the importance in modular implementation and well defined interfaces between subsystems in the development of autonomous combat robots[1]. The military forces of the future will use multi-agent robotic workforces for reconnaissance and surveillance, logistics and support, communications infrastructure, forward-deployed offensive operations, and as tactical decoys to conceal maneuver by manned assets. Towards this end, there is a clear and definite need for optimal, multi-robot control strategies in the synthesis, design, implementation, and semi-autonomous teams of combat robots for military systems. Proven coordination methods are essential to enable interactions with in dynamic and hostile environments, synchronized maneuvers, sensible and robust (ROE), and reliable field behavior[2]. Intelligent robotic systems have been extensively applied in factory automation, space exploration, intelligent buildings, surgery, military service, and also in our daily life. Various remote control methods have been performed for intelligent robotic systems, such as radio, microwave, computer networks, etc. Nowadays, the computer network services have broadly used in our daily life, such as FTP, Telnet, the World Wide Web, e-mail, etc. Consequently, it is very convenient to use the Internet to control intelligent robot, and the users will increase in the future. In the past few years, many researchers have been using the Internet as a command transmission medium which can control the intelligent robot and obtain feedback signals. Although the Internet has many advantages in a variety of fields, using the Internet to control intelligent robots also has some limitations, such as the uncertain time-delay problem, the uncertain data-loss problem, and the data-transmission security problem. Many experts proposed various methods to solve these problems and analyze the effects on the remote control systems caused by these problems. The intelligent robot can simultaneously present low-level navigational capabilities, medium-level self-positioning capabilities, high-level motion-planning capabilities, and the ability to be controlled through the Internet. The issues for controlling intelligent robots through the Internet will be discussed in terms of direct control, behaviour programming control, supervisory control, and learning control[4].

II. Block Diagram

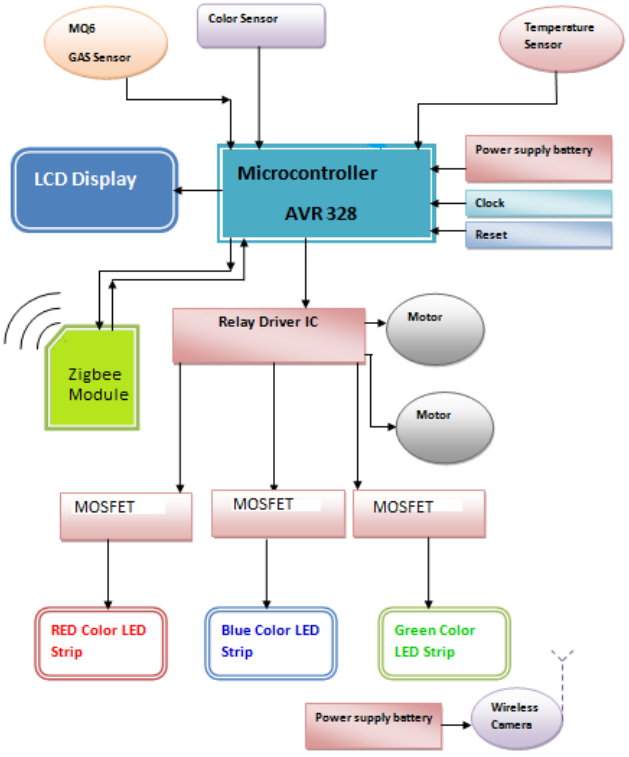

Figure 1.Block Diagram of transceiver section-1

Block diagram description :

Figure.1 shows the transceiver section-1 from the bot side system. This transceiver section consists of one Zigbee which is belongs to the series 1 type. Transceiver section-1 consists of following hardware components :

- Microcontroller AVR 328P-PU
- L293D motor driver IC

- Zigbee transreceiver module
- LCD display
- MQ6 Gas sensor
- Colour sensor
- Temperature sensor
- Power supply
- Reduction Geared Motors
- MOSFET IRFZ44
- LED strips
- Wireless camera

ATmega328P-PU microcontroller is considered as the heart of the bot system. All other components are connected to the microcontroller AVR 328 to satisfy various functional needs of the bot. Motor driver L293D is connected to the AVR 328 microcontroller to control the movements of the bot like moving the bot in forward direction ,Backward direction ,Left turn and Right turn. At this time Zigbee is act as a receiver module. Whatever instructions from the host terminal side are transmitted they are received by this zigbee and according to the instructions given bot will move. From colour sensor microcontroller takes the 8 bit values of RED, GREEN, BLUE colour and AVR 328 converts it into PWM signal. This PWM signal is given to the MOSFET IRFZ44. This PWM signal controls the ON-OFF state of the MOSFETs to give the colour along which bot is treads. For that at the output side of MOSFETs REB,GREEN, BLUE colour Led strips are connected. MQ6 Gas sensor is used to detect the ammable gases present around the Bot. For temperature sensing purpose NTC type thermister is used. This thermister and MQ6 gas sensor is also connected with the AVR 328. LCD dislpay is also connected with the AVR 328. LCD is used for reading the data. wireless camera is used for spying purpose. Wireless camera will capture real time video,audio and images of surrounding and transmit it to the operator. This camera requires 9V power supply and is referred as a stand alone unit. Wireless camera receiver is used for displaying purpose.
Tuning frequency range for camera receiver is 800-900 MHz. Receiver requires RF signal display which is provided by TV Tuner card. This card help to record the video onto hard disk of computer . In this way, capturing and storing of video and audio will be done.

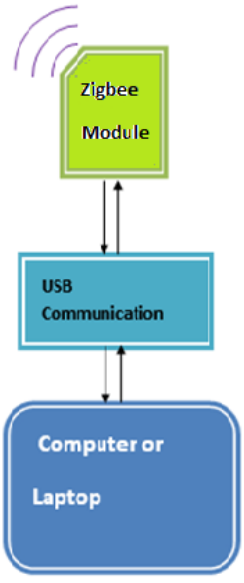

Figure 2. Block Diagram of transceiver section-2

It consists of following Hardware components :
_ Zigbee Transreceiver module
_ CP2102 single-chip USB to UART Bridge
_ AMS 1117-3.3 H1518 IC

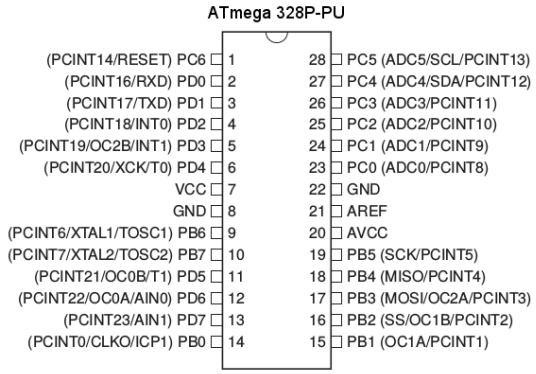

Figure 3. Pin Configuration

Figure.3 shows the Pin configuration as
1. VCC : Digital supply voltage.
2. GND : This pin is Ground(0 volt).
3. Port B : ((PB7-PB0) XTAL1/XTAL2/TOSC1/TOSC2) Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tristate when a reset condition becomes active, even if the clock is not running. Depending on the clock selection fuse settings, PB6 can be used as input to the inverting Oscillator amplifier and input to the internal clock operating circuit. Depending on the clock selection fuse settings, PB7 can be used as output from the inverting Oscillator amplifier. If the Internal Calibrated RC Oscillator is used as chip clock source, PB7...6 is used as TOSC2...1 input for the Asynchronous Timer/Counter2 if the AS2 bit in ASSR is set.
Port C : (PC5-PC0) Port C is a 7-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The PC5...0 output bu_ers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tristated when a reset condition becomes active, even if the clock is not running.
5. PC6/RESET : If the RSTDISBL Fuse is programmed, PC6 is used as an I/O pin. Note that the electrical characteristics of PC6 di_er from those of the other pins of Port C. If the RSTDISBL Fuse is unprogrammed, PC6 is used as a Reset input. A low level on this pin for longer than the minimum pulse length will generate a Reset, even if the clock is not running.
6. Port D : (PD7-PD0) Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output bu_ers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tristated when a reset condition becomes active, even if the clock is not running.
7. AVCC: AVCC is the supply voltage pin for the A/D Converter, PC3:0, and ADC7:6. It should be externally connected to VCC, even if the ADC is not used. If the ADC

is used, it should be connected to VCC through a low-pass filter. Note that PC6...4 use digital supply voltage, VCC.

8. AREF : AREF is the analog reference pin for the A/D Converter.

9. ADC7-6 : (TQFP and QFN/MLF Package Only) In the TQFP and QFN/MLF package, ADC7:6 serve as analog inputs to the A/D converter. These pins are powered from the analog supply and serve as 10-bit ADC channels.

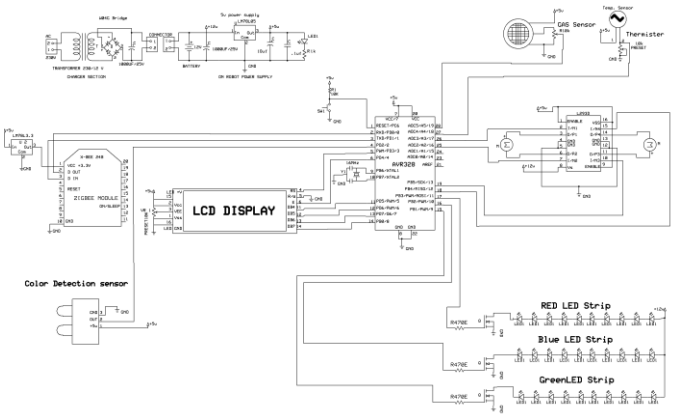

Figure 4. Circuit Diagram of transceiver section-1

Figure.4 shows the transceiver section-1 circuit from the bot side system. This transceiver section consists of one Zigbee which is belongs to the series 1. Transceiver section-1 consists of Microcontroller AVR 328P-PU, L293D motor driver IC, Zigbee transreceiver module, LCD display, MQ6 Gas sensor, Colour sensor, Temperature sensor, Power supply, Reduction Geared Motors, MOSFET IRFZ44, LED strips, Wireless camera.The objective behind making this system deals out with satisfying various functional needs such as secretly spying or keeping surveillance over a desired target location. So to overcome over motive we will interface various component with Micro-Controller to control spy robot. ATmega328 microcontroller is considered as the heart of the bot system. The ATmega328 is a single chip micro-controller created by Atmel and belongs to the mega AVR series. The Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP ash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three exible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughputs approaching 1 MIPS per MHz. All the movements of the robot that is forward, backward, left,right are controlled with the help of microcontroller and driver IC. IN and OUT pins of Zigbee module are connected to transmitter and receiver pin of ATmega328 respectively. Zigbee transceiver modules operate in the physical layer. When two Zigbee transceiver modules are initialized with the same address, they operate as a transmitter-receiver pair alternately. The wireless technology of Zigbee operates at an average range of 10-100m within the line of sight. When a command is given from host terminal i.e PC/Laptop. Zigbee transmitter transmits signal to the Zigbee receiver and the bot moves accordingly using L293D motor

driver IC. Pin no. 26,25,19,18 of ATmega328 are connected to 2,7,10 ,15 pin of driver IC respectively. Pin no. 4,5,12,13 of driver IC are connected to the ground. Pin no. 3 and 6 of driver IC are connected to positive and negative terminal of

left dc motor respectively. Pin no.11 and 14 of driver IC are connected to right dc motor. According to input command given, when both the positive terminals of motors goes high bot moves forward and when both negative terminals goes high, robot moves backward. When positive of left motor and negative of right motor goes high bot moves in right side direction and when negative of right motor and positive of left motor goes high bot moves toward left side direction. In this way movement of spy bot will be controlled. For secretly spying we are adding the feature of camouaging in our robot. Color sensor detects surrounding color , it requires 5Vsupply for working. It provides feedback to the microcontroller and then microcontroller again generates a signal to illuminate LED strips. Color sensor module consists of LED and photodetector. Photodetector OUT pin no. 2 is connected to pin no.4 of ATmega328 microcontroller. LED gives the reference light source and photodetector detects the color

value. It can identify 16.7 million colour shades giving RGB value for the detected colour. The detected colour is identi_ed as amount of three primary colour values namely Red, Green Blue with 8 bit accuracy for each primary colour. Any colour

can be separated or combined into three primary colours Red, Green and Blue. Output of color sensor is in the form of pulse width modulation. It is in serial data form. The color sensed by the sensor need to be regenerated.

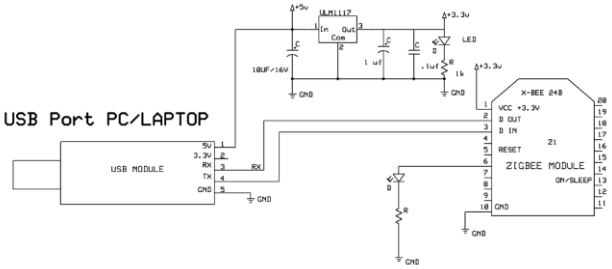

Figure 5. Circuit Diagram of transceiver section-2

Figure.5 shows the transceiver section--2 circuit from the host terminal side system. It consists of Zigbee Transreceiver module, CP2102 SINGLE-CHIP USB TO UART BRIDGE, AMS 1117-3.3 H1518 IC. Transceiver section 2 of the proposed system consists of another Zigbee transceiver module, which is used as transmitter when instructions to move the bot are given from the host terminal. This Zigbee is

acts as a receiver in case of the MQ6 Gas sensor , temperature Sensor. This Data send by from the microcontroller via Zigbee series 1 is receive by the Zigbee which is present at the host terminal side. CP2102 is a single-chip USB to UART BRIDGE. This CP2102 modules USB function controller manages all data transfers between the USB and the UART as well as command requests generated by the USB host controller and commands for controlling the function of the UART. CP2102 obtain the data from the Zigbee. The AMS1117 series of adjustable and fixed voltage regulators are designed to provide up to 1A output current and to operate down to 1V input-to-output differential. AMS 1117-3.3 H1518 is used to covert the supply voltage from the host terminal into

3.3 Volts. This 3.3 volts supply is given to the Zigbee module.

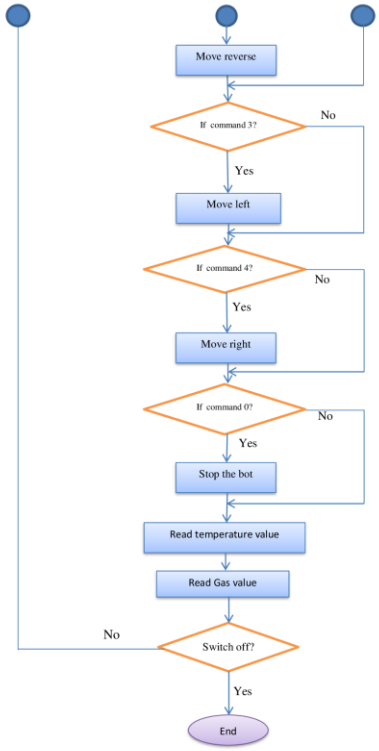

Figure 6. Flowchart of the system

III. EXPERIMENTAL RESULTS

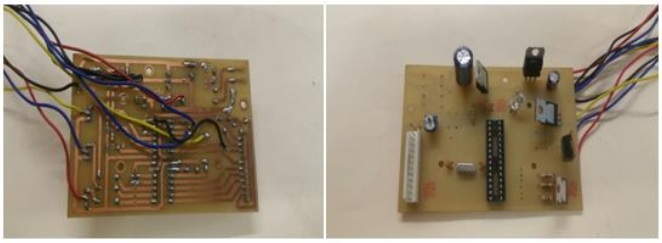

Figure 7: Hardware of Circuit Design

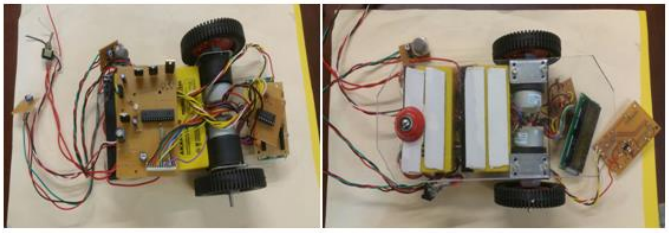

Figure 8: Hardware of Final Circuit

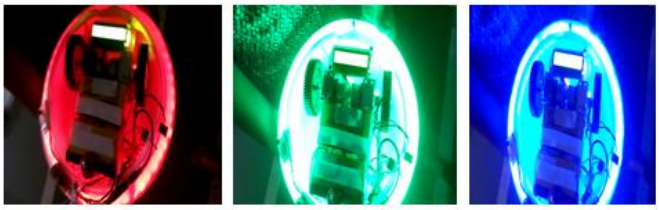

Figure 9: Simulation Result-1

When bot is switched ON, it will show the RED, GREEN and BLUE colours respectively with the interval of 0.5 sec as shown in Figure 9.

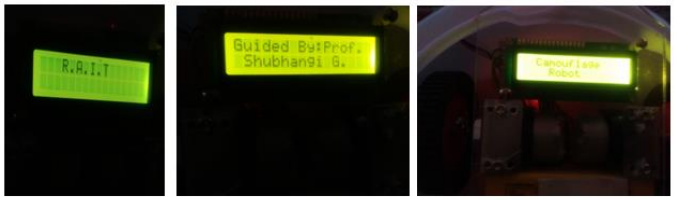

Figure 10: Simulation Result-2

Then after immediately LCD will show Name of the College, Name of the Project Guide, Name of the Project respectively as shown in Figure 10. This LCD results will help us to know that microcontroller is in properly working condition ,
Whenever we fail to receive the results on GUI window of host terminal.

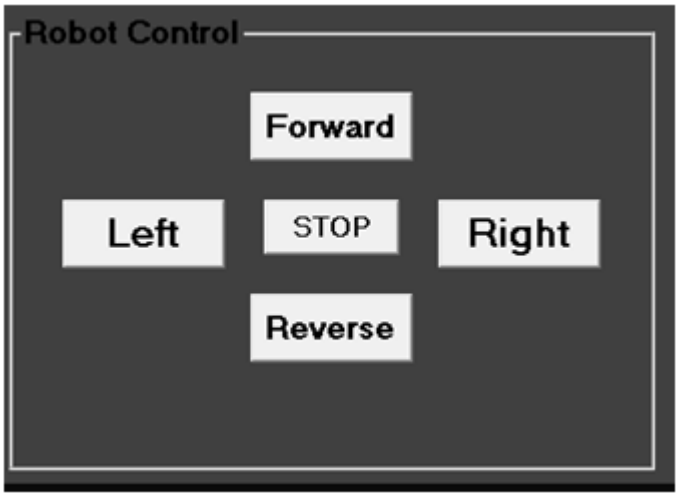

Figure 11: Simulation Result-3

The zigbee transceiver module is used to instruct the bot based upon the commands given through command window of GUI of host terminal. Robot control command window look like as shown in Figure 11.

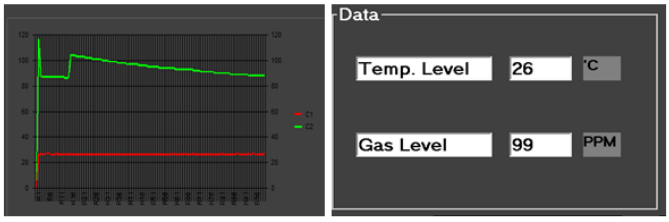

Figure 13: Simulation Result-4

The information about temperature and gases is properly detected and send to the host terminal via Zigbee transceiver module. Both the informations are displayed in Visual Basic 6 application GUI and corresponding change in sensor values is also shown in graphical format as shown in Figure 13.

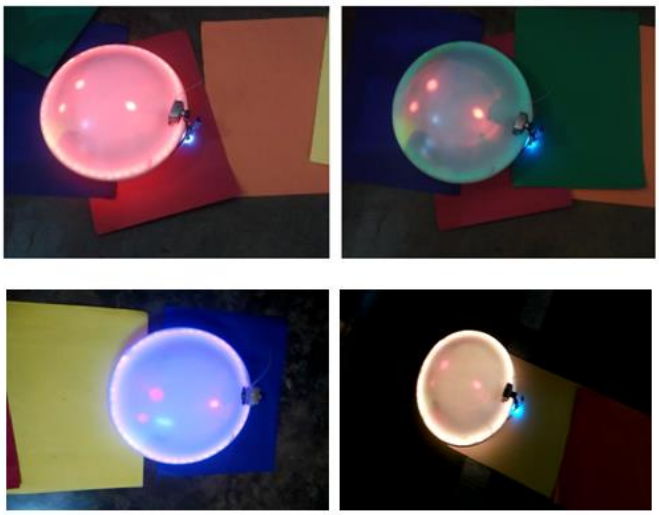

Figure 14: Simulation Result-5
Bot adopts the colour of its background along which it is moving. Figure 14 shows that bot has successfully achieved the camouage property.

IV. CONCLUSIONS

We have assembled a bot that consist of transmitter and receiver circuit. The bot moves according to the commands given by host terminal. In this system a wireless camera is used for surveillance purpose and monitoring of targets within the line of site. We used ZigBee transceiver pair for encoding and decoding of signals. We constructed the bot which will change its color according to its background along which it is moving and can be easily hidden from enemies. We used gas sensor for detection of ammable gases and a thermistor for measurement of temperature present around the bot. We used Visual Basic 6 GUI to display gases and temperature values, command control grid, COM port selection grid along with audio and Video information on the host terminal.

Future Scope

- Bot can be configured for multicolour camouaging. So that it can almost convert his body color with texture according to background like nature.
- Metal Detector can be added at the base of the robot for detecting land mines.
- X-ray can be used for detecting any hazardous material like bombs.
- Bot can be used for its operation in self operated mode or autonomous mode.
- Automatic obstacle detection and Surface detection can be achieved.
- Bot can be made to work under range of 300 to 1000 meters efficiently by using
- The advance versions of the ZigBee Modules.

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