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Stealth Bot Harnessed with Wireless Technology

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***Abstract*— There have been tremendous developments in the field of robotics in the recent modern times. A robot could be anything from a toy car at home to an automation machine. Our goal is to create a wirelessly controlled robot that could provide us with a host of military based services like patrolling, spying, detection of landmines, combustible gases, fire and obstacles. These could be attained with the help of a wireless night vision camera, variety of sensors, display and CC2500 wireless technology for controlling the robot.**

Keywords—ATMEGA16, CC2500, embedded C, wireless night vision camera, spy robot.

I. INTRODUCTION

Robotics is the branch of technology that envelopes the design, construction and implementation of a robot for replacing humans in complex operations for the sake of increasing efficiency and accuracy and minimizing errors. In recent times our planet is faced with a number of threats that endanger human lives especially wars and calamities. On a daily basis hundreds of lives are lost in wars, which is tragic. Hence we aim at designing an electromechanical device that could serve us in war fields in a better way than humans[1]. It also solves the purpose of saving lives on a global level.

Our robot's circuitry is mounted on a chassis made of medium density fiber which replaces a metal one to reduce weight and corrosion of the robot. We have used linked track belts which eases the motion of bot in multiple terrains fitted on suitable wheels provided with slots for the belts to fit in. Here, the microcontroller ATMEGA16 serves as the brain our robot and plays an instrumental role in driving the rest of the circuitry.

The main purpose of our bot is patrolling the war regions and providing us with the audio & video feed which we could watch on a monitor. Also the bot provides an alert if it encounters the presence of metals (ex. Landmines), smoke for fire detection, obstacles and temperature sensing. The communication technology we have used is CC2500 over the basic RF for the luxury of extended range and security[2].

II. WORKING

At the Transmitter section, when the input switch is turned on, an input is given to the microcontroller. The microcontroller then instructs the CC2500 transmitter to transmit the signal so as to operate the robot.

Fig: Generalized block diagram of Spy Bot

At the receiving side the signal is detected by the CC2500 receiver. This signal drives the microcontroller ATmega 16. Selecting a Template

Various sensors such as gas sensor (MQ2), heat sensor (LM35), metal detector (LM358), IR sensor (LM324) for obstacle detection are connected to the port A of microcontroller. The gas sensor MQ2 detects the presence of smoke in the atmosphere. The LM35 is a temperature sensitive IC whose output is proportional to the temperature (in ^{o}C). An LCD display is connected; it shows the status of the temperature sensor. A buzzer rings when the corresponding sensors detect presence of fire, metal or an obstacle.

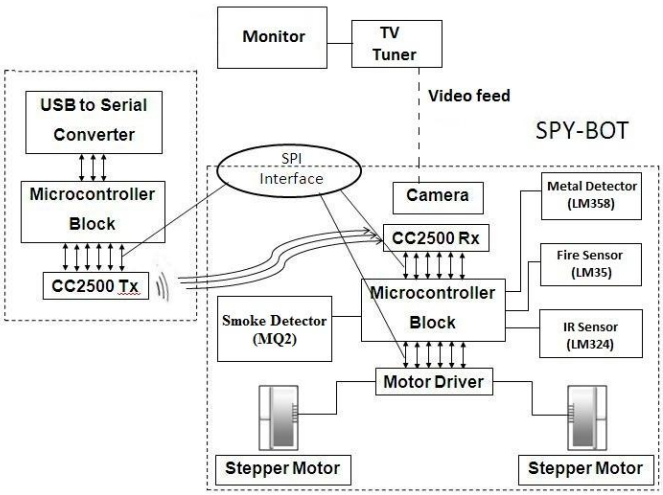

Fig: Block Diagram of overall communication

Microcontroller operates at 5 volts but to run the DC motors we require 12V supply, so we use motor driver IC L293D. An L293D can be used for operating 2 motors, so we are using 2 motor driver ICs for 4 motors. L293D is a 16 pin IC whose inputs are at pin no. 2, 7 10, and 15. The motors are connected at pin no. 3, 6, 11, and 14.

The DC motors gets its supply voltage of 12V from motor driver IC. The motors used are of 100 rpm.

III. TECHNOLOGIES USED

I. CC2500:

- CC2500 is a low power 2.4 GHz RF Transceiver. It has 64 bytes transmit/receive FIFOs.
- It is controlled via SPI interface with the microcontroller with CC2500 as a slave and microcontroller in the master mode.

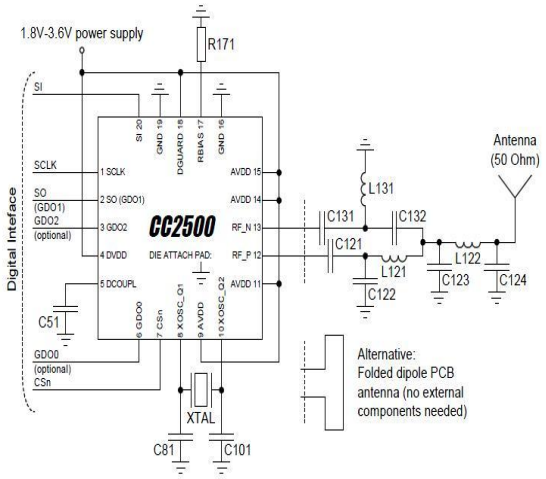

Fig. CC2500 Transceiver module schematic

II. Motor Driver IC L293D:

- The DC motors used require 12V for operating whereas the microcontroller supplies 5V. Hence motor driver IC amplifies it to 12V before providing it to the motors.

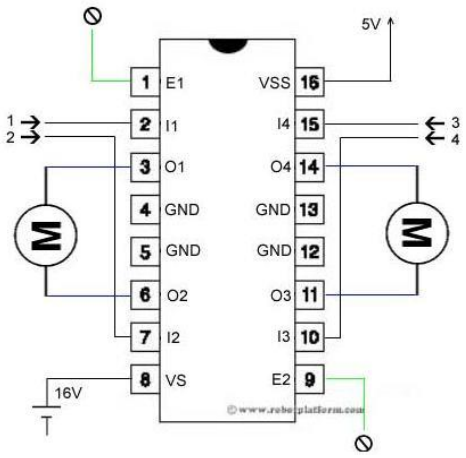

Fig. Driver IC-motors interfacing

III. Wireless Night Vision Camera:

Night vision is the ability to see in low light conditions. Whether by biological or technological means, night vision is made possible by a combination of two approaches: sufficient spectral range, and sufficient intensity range. Humans have poor night vision compared to many animals, in part because the human eye lacks a tapetum lucidum.

Features:-

- Range of 70 to 100 meters “straight line of sight”.
- Resolution is 380 TV lines.
- Low illumination of 3 lux.
- Camera/transmitter operates on 9V battery.

IV. SENSORS USED:

1) Metal Detector:

Metal detector is an electronic instrument which detects the presence of metal nearby. Metal detectors are useful for finding metal inclusions hidden within objects, or metal objects buried underground. They often consist of a handheld unit with a sensor probe which can be swept over the ground or other objects. If the sensor comes near a piece of metal this is indicated by a changing tone in earphones, or a needle moving on an indicator. Usually the device gives some indication of distance; the closer the metal is, the higher the tone in the earphone or the higher the needle goes. Another common type are stationary "walk through" metal detectors used for security screening at access points in prisons, courthouses, and airports to detect concealed metal weapons on a person's body.

We are making the use of LM 358 for the detection of presence of metallic threats like landmines in war fields.

Features-

- Wide range of supply
  – Single Supply: 3V to 32V
  – Or Dual Supplies: ±1.5V to ±16V
- Very Low Supply Current Drain(500 μA)
- Large Output Voltage Swing
- Large DC Voltage Gain: 100 dB
- Wide Bandwidth (Unity Gain): 1MHz(Temperature Compensated)

2) Gas Sensor:

A gas detector is a device that detects the presence of gases in an area, often as part of a safety system. This type of equipment is used to detect a gas leak and interface with a control system so a process can be automatically shut down. A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals.

Gas detectors can be used to detect combustible, flammable and toxic gases, oxygen deplet ion. This type of device is used widely in industry and can be found in locations, such as on oil rigs, to monitor manufacture processes and emerging technologies such as photovoltaic. They may be used in firefighting.

The Gas Sensor MQ2 is used for detection of combustible gases to eliminate combustion threats in war fields or even in industries. The key advantages of the sensor include cheaper cost, durability and simplicity of the drive circuit.

Features:

- The conductivity of the sensor increases with increase in concentration of the gas.
- It has high sensitivity for gases such as methane, propane and LPG.
- Power of Sensitivity body(P_s):
  $P_s=V_c^2 \times R_s / (R_s + R_L)^2$

3) Smoke Sensor:

Smoke detector is a device that senses smoke, typically as an indicator of fire. Commercial and residential security devices issue a signal to a fire alarm control panel as part of a fire alarm system, while household detectors, known as smoke alarms, generally issue a local audible or visual alarm from the detector itself.

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature.

Features:-

- Calibrated Directly in Celsius (Centigrade).
- Rated for Full −55°C to 150°C range.
- Low-Cost Due to Wafer-Level Trimming.
- Operates from 4 V to 30 V.
- Less than 60-µA Current Drain

4) IR Sensor:

An infrared sensor is an electronic device that emits and/or detects infrared radiation in order to sense some aspect of its surroundings. Infrared sensors can measure the heat of an object, as well as detect motion. Many of these types of sensors only measure infrared radiation, rather than emitting it, and thus are known as passive infrared (PIR) sensors.

All objects emit some form of thermal radiation, usually in the infrared spectrum. This radiation is invisible to our eyes, but can be detected by an infrared sensor that accepts and interprets it. In a typical infrared sensor like a motion detector, radiation enters the front and reaches the sensor itself at the center of the device. This part may be composed of more than one individual sensor, each of them being made from pyroelectric materials, whether natural or artificial. These are materials that generate an electrical voltage when heated or cooled.

An IR sensor which is also known as an obstacle detector sensor detects whether the path of the robot is interrupted by any obstacle or not. If an obstacle is detected, an LED glows indicating that the path of the robot should be changed.

IV. FUTURE SCOPE

- This robot can be used as a military-dedicated one and can serve the defence forces for performing the tasks of patrolling and spying and detection of factors like temperature, smoke, metal and obstacles to face hostile situations and calamities.
- An algorithm can be developed to grant the robot autonomy to deal with such situations and a camera with distant range could be used.
- Also the night vision camera we have used could be replaced with an ‘Internet Protocol’ camera which gives us the liberty to control the camera via computer and internet.

V. SNAPSHOTS

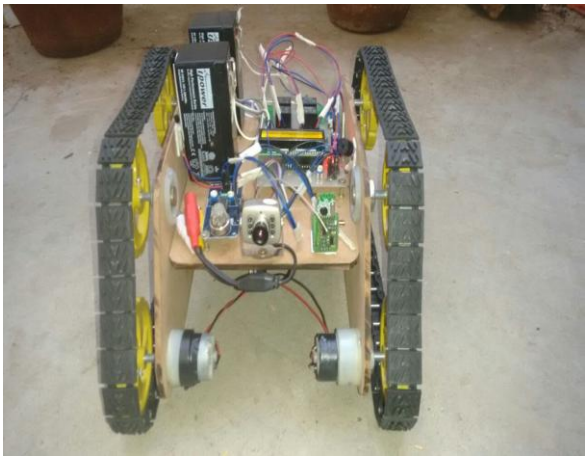

Fig. The front view of spy bot.

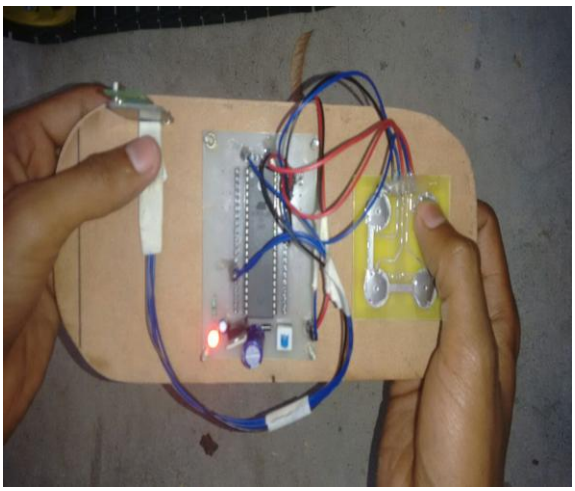

Fig. Top view of the remote.

VI. CONCLUSION

Thus, we have constructed a robot which serves all the military based applications mentioned in this paper using a night-vision camera and requisite sensors.

The replacement of basic AT89C51 microcontroller by Atmega16 microcontroller in our project which provides us with faster speed of operation with superfluous instruction set at our disposal.

Also we have implemented the use of CC2500 over the basic RF communication technology for better range and to achieve immunity against interference.

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