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Operative Scout Cyborg

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Abstract: Protection of human life is the most important as we all know. This project is an attempt to secure the human lives in life risking situation. This project concerns with the design and fabrication of the Operative Scout Cyborg for Military Aid. It will be useful for spying purposes to get the essential details about the critical surroundings in intense situations without risking the human life. The main application of the robot is to help the military and the police department. The design consists of GSM interface for controlling the robot and for receiving the feedback about the conditions in remote area. As the robot will be used for military applications, to increase the compatibility of the robot we have provided Bluetooth control as well. It will perform functions such as human detection, gas detection, obstacle detection, temperature detection, humidity detection and it will also measure the distance of obstacle using ultrasonic sensor. It will also provide the live streaming of the critical environment using a wireless camera. To ensure authentic access we have provided RFID card swipe system.

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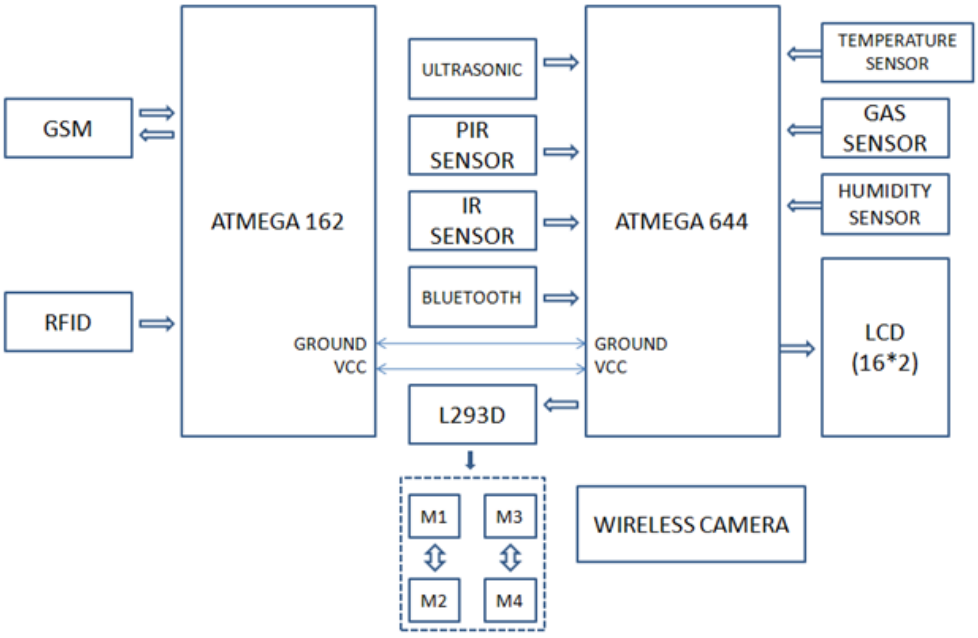
I. INTRODUCTION

A Robot is a virtual artificial agent. In practice, it is usually an electro-mechanical machine which is guided by computer, mobile or electronic programming, and is thus able to do tasks on its own.ISO describes a robot as "an automatically controlled reprogrammable, multipurpose in three or more axes, which may be either fixed in place or mobile for an industrial automation applications". Robotics is one of the fields of modern age in which the nations are concentrating upon, for military purposes in the state of war and peace. They have been in use for some time for demining and rescue operations but now they are under research for combat or spy missions. Due to the characteristics of the robot the military forces always try to use new gadgets and robots for reducing the risk of their casualties and to defeat their enemies. Conventionally, wireless controlled robots use RF circuits, which have drawbacks of limited working range& frequency range. Use of GSM can overcome this limitation .The Operative Scout Cyborg uses GSM for controlling and feedback. For short range applications we have supplied Bluetooth control and it will also save some time. As the main objective of the robot is to reduce the risk attached to the lives of military forces the robot provides all the important information like temperature, gas, humidity about the environment. It also gives the information about the presence of humans on the other side. The camera will ensure the live streaming for the surveillance of the surrounding to know the situation of the attackers as well as of the survivors or hostages.

Hence we focus our attention on the application of robot in various critical situations in order to contribute to the safety and security of the society.

II. BLOCK DIAGRAM



III. THEORITICAL ANALYSIS

In this project we are using atmega162 and atmega644 microcontroller for interfacing various sensors and the hardware peripherals required for the proper working of the robot. Atmega644 is used due to the availability of its analog port. As our project has GSM interface as well as Bluetooth interface we need two USART's therefore we have selected atmega162 for that purpose.

A. Atmega162

The ATmega162 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. We have used Atmega 162 because it has two USART's for serial communication. It achieves a throughput of 1MIPS per MHz

B.Atmega 644

The ATmega162 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC Architecture. We have selected Atmega 644 because it consists of an analog port. It provides a throughput up to 20MIPS at 20 MHz.

C.GSM (SIM 900)

The SIM900 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900 can fit almost all the space requirements in your M2M application, especially for slim and compact demand of design.

D. Bluetooth (v1.02 JY-MCU)

We have connected a Bluetooth to the microcontroller for fast controlling of the robot. We will send commands from an android phone to the Bluetooth module on the robot. It runs in a slave mode. It works in the ISM band of centre frequency 2.4GHz.

E. Motor driver

We have used L293D for the motor driver. It is a 16 Pin IC. It provides 12V output voltage and it provides 600mA output current. We have used only one motor driver to control all the four motors. The two left side motors are connected in parallel therefore both the motors get the same commands. The same is done for the two right side motors. Logic 0 is provided as the input to the motor driver by the micro controller to give 0V at the output and logic1 to provide output as 12V.

IV. FEATURES

A.Authentic access

The RFID used is rhydoLABZ RFID-1321. The RFID reader reads EM4100 family transponder tags that are brought in proximity to the reader and output the unique tag identification number through serial port @9600 bps. The reader output 12 byte including one start, stop byte and 10 unique data byte. The start byte and stop byte are used to easily identify that a correct string has been received from the reader. The middle ten bytes are the actual tag's unique ID. Its read frequency is 125KHz.

B. Obstacle Detection

We have provided the feature of obstacle detection using IR sensors. It detects obstacles on its left, right and in front of it. IR transmitter is a special purpose LED that transmits infrared rays in the range of 760 nm wavelength.

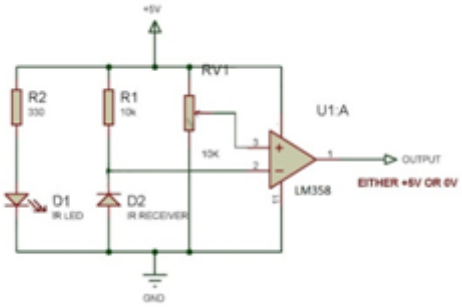


Fig. IR Sensor circuit diagram

As we understand the importance of knowing the exact position of the obstacle, we have used ultrasonic sensor for that purpose. The ultrasonic sensor measures the distance of the obstacle from the robot. The ultrasonic sensor transmits a sound wave and receives it back after getting reflected from the obstacle. The distance is calculated by the time required to receive the sound wave by the ultrasonic sensor.

C. Human Detection

PIR sensors (passive infra red sensors or pyroelectric infrared sensor) detect infrared radiation on the basis of the characteristics that the polarization of pyroelectric material changes with temperature. Dual compensated sensing elements are applied to suppress the interference resulting from temperature variation. As a result, the operating stability of the sensor is greatly improved.

Fig. Field of circuit

D. Detection of Environmental conditions

Our project detects the surrounding temperature, humidity and the percentage of gasses present in the air. We have used LM35 for temperature detection, MQ2 as a gas sensor and SYHS 220. The typical range of temperature sensor−55° to +150°C.The humidity sensor calculates the relative humidity. The humidity range of this sensor is 30-90%. The gas sensor MQ2 detects the percentage of combustible gasses in the air. MQ-2 gas sensor has high sensitivity to LPG, Propane and Hydrogen, also could be used to Methane and other combustible steam, it is with low cost and suitable for

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different application. Concentration of MQ-2 sensor is 300-10000ppm.

E. Live streaming of the surrounding

The wireless camera module helps in live streaming of the surrounding. The imaging sensor used in the camera is CMOS. The Transmission frequency of this camera is 400MHz ~ 2,483MHz and the receiving frequency is 400MHz ~ 2,483MHz. Intermediate frequency is 480MHz. The modulation and demodulation type is FM.

V. PROPOSED METHODOLOGY

A.Temperature detection

- LM35 will sense the temperature and convert it into equivalent voltage.
- The voltage will be read and converted into degree Celsius by the formula :
- Temperature(Celsius)= VOut*(100˚ Celsius /V)
- As the sensitivity of LM35 in 10mv/degree Celsius, the conversion factor becomes 100˚Celsius /V.
- After calculating the temperature it will be transmitted a message through GSM and will also display the temperature on the LCD display.

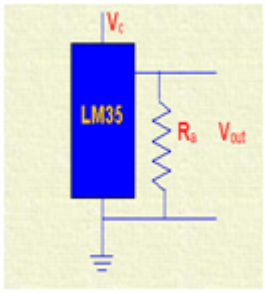

Fig. LM 35

B. Human detection

- We will be using passive infra red sensor for the purpose of human detection.
- The PIR sensor is made up of a material called pyroelectric.
- As human beings are warm bodies and have a temperature above absolute zero they emit infra red rays.
- When the human being comes in the range of PIR sensor, the infra red rays intercept one half of the two slots of PIR and cause a positive differential change between the two halves.
- The output pin will be connected to a microcontroller pin which will go high on receiving positive value which will indicate the presence of a human being or an animal.
- As the microcontroller pin will go high the gsm will be programmed to send a message to the user and will also display it on the led.

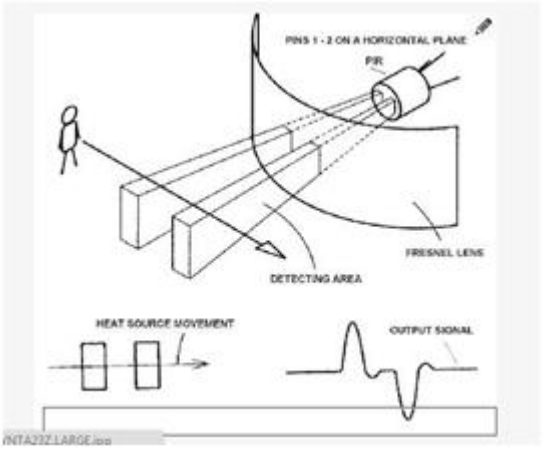

Fig. Diagrammatic concept of PIR sensor

C. Gas Detection

- When the infrared transmitter and receiver are kept in front of each other very close to each other, the receiver continuously receives the infrared rays. Therefore the microcontroller pin will receive a high input.
- When gas is detected the receiver stops receiving the IR rays and the output to the microcontroller pin goes low.
- When the pin detects a zero that indicates presence of some gas.
- When the microcontroller pin goes low the GSM will send a message to the user and as well as display it on the LCD.

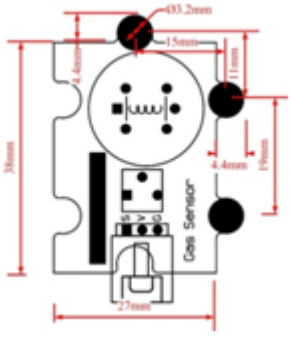

Fig.Layout of gas sensor

D. Humidity detection

- Resistive type humidity sensors pick up changes in the resistance value of the sensor element in response to the change in the humidity.
- A polymeric film on the electrodes acts as a humidity sensing film due to the existence of movable ions. Change in impedance occurs due to the change in the number of movable ions.

E. Obstacle detection:

- The IR transmitter continuously transmits rays in the forward direction, when the obstacle is detected the IR rays are reflected and received by the

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transmitter and sends a high output signal to the microcontroller pin.

- Hence in this way the obstacle is detected.

F. Obstacle and human distance measurement:

- For this purpose we will be using a ultrasonic sensor, the ultrasonic sensor is made up of a piezoelectric material which emits ultrasonic rays.
- When the obstacle is detected the ultrasonic rays will enter the ultrasonic vibrator and will produce a electric signal.
- A PWM signal is generated at the output.
- As the electric signal is detected the microcontroller pin goes high and then the time between transmission and reception is calculated by the Ton(high pulse) obtained in the PWM signal.
- The Ton is calculated by using a timer, by first triggering it at the rising edge and then the timer will be turned off when the falling edge is detected.
- The Ton pulse is proportional to the distance of the obstacle from the robot.
- Therefore the distance between the obstacle or human being and the robot is calculated by the following formula:

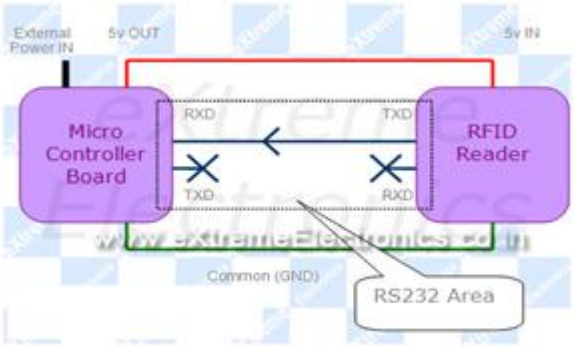
  Distance (D) = velocity of sound*(Time/2)

H.Robot movement:

- Every motor will have two inputs and according to the input given we can control the motor.
- The movements allotted to the motor as follows:
  10-clockwise rotation
  01-anticlockwise rotation
  00-stop
- The left side DC motors are connected in parallel and so are the right hand side motors. Therefore both the motors will move in the same direction.
- The pin assignment is as follows-
  PD.4-front right motor
  PD.5- rear right motor
  PD.6- front left motor
  PC.7-rear left motor
- When the user transmits a message ‘right’ the following will be written on port C:00001010
- When the user transmits a message ‘left’ the following will be written on port C:10100000
- When the user transmits a message ‘forward’ the following will be written on port C:10101010
- When the user transmits a message ‘stop’ the following will be written on portC:00000000

I.Security system:

- We will be using RFID card system for accessing the robot.
- The electronically stored information on the card is transmitted through electromagnetic waves and the RFID receiver continuously receives the EM waves.
- When the information matches the output of the RFID is given to the microcontroller pin which will become high and enable the access to the robot.



Typical Interface between MCU and RFID Reader

J.GSM (SIM900):

- The hardware (inside the AVR MCU Chip) that is used for serial communication is called the UART, we use this UART to communicate with the SIM900 module
- The basic communication is over asynchronous serial line.
- The data is transmitted bit by bit in a frame consisting of a complete byte. Thus at high level it is viewed as a simple text stream.
- There are only two streams one is from MCU to SIM900 and other is from SIM900 to MCU.

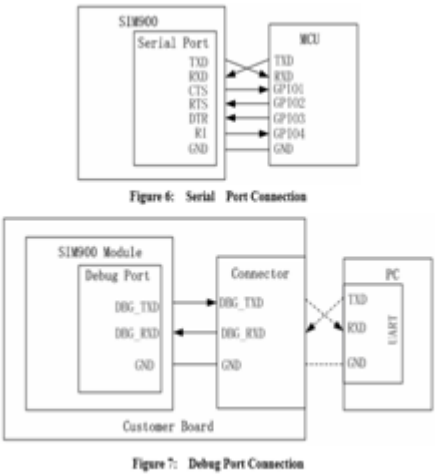


Fig. GSM interfacing

VI. ADVANTAGES

1. The use of GSM has widened the range of communication between the robot and the user.
2. We have provided as many alternatives as possible to the robot like, two controlling methods namely

GSM, Bluetooth control. We have also provided RFID method for authentic access.

3. The robot sends feedback about the complete surrounding with small details like presence of human or any other obstacle and also sends a feedback about at what distance the obstacle or human is present which is very vital to tackle any intense situation.
4. In case the detection goes fail we have given it the provision of live streaming so as to get visual knowledge about the surrounding.

VII. DISADVANTAGES

1. At some places it is possible that the GSM will have no range, therefore the range for controlling the robot may get reduced.
2. As there are many sensors interfaced to the robot, the feedback time is increased and the robot will also need time to time maintenance.
3. The GSM controlling is comparatively slow since it takes time for it to transmit text messages.

VIII.CONCLUSION AND FUTURE SCOPE

The robot decreases the risk of the human lives in critical situations. It will help the military and the police department to deal with many hostage situations and terrorist attacks and to survey the environment of a particular area before dispatching its army in that area. In short it will save human lives without causing any danger to the rescue squad which was the main aim of our robot.

In future we can use sharp sensors for obtaining more accurate results about the conditions of the surrounding and environment. We can also use XbeePro instead of Bluetooth to increase the range of controlling when there is an issue of range and the working of GSM fails. We can provide a medical kit on the robot to help the injured people. We can also add the GPS module to get the exact locations.

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