

ARDUINO CONTROLLED HANGING ROBOT FOR INDUSTRY MONITORING USING WIRELESS ZIGBEE

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ABSTRACT

This project proposed an ARDUINO controlled system for safety purpose robot using wireless ZigBee. The robot has sensors for detecting gas leakage. The MQ2 smoke sensor is sensitive to smoke and following gases are, LPG, Butane, Methane, Alcohol, Hydrogen. Automatically send the sensor information to more number of places using ZigBee mesh network. The system also provide any abnormal change in the parameters gives an alert using buzzer for the safety and security purpose. The robot movement can be controlled by without human work using wireless ZigBee. This type of robot easily working in dangerous place.

Keyword - ARDUINO UNO, hanging robot, ZIG-BEE, Sensors, RF.

1. INTRODUCTION

In this project we propose hanging robot Model system. This Robot mainly using in industrial purpose and also in petroleum industry. The data can be collected and controlled through ZigBee. If the gas and temperature sensor value increases it send the alert signal to the buzzer and also it will measure light intensity using LDR sensor in case of fire. This have a safety setup for stopping the gas flowing and cooling fan if the values changes in sensors means precaution steps will be taken automatically. Because of the proposed hanging robots significant features such as gas detection, light intensity, multi-parameter measurements(sensors), and wireless transmission of measurements data in abnormal situation in the industry. An industrial hanging robot consists of transducer (sensors) based wireless network through ZigBee integration which acts as both receiver and transmitter. The wireless modules continuously transmit data between the host (computer) and the client (robot). The goal is to find an economical solution for the robot to traverse through rope path using travel robot. Also, to implement the system without human work using ZigBee module with programming microcontroller. This have a safety setup for stopping a gas flowing and cooling fan if the value changes in sensors means precaution steps will be taken automatically.

2. LITERATURE REVIEW

Gas is a rich source for house and industry in India, so safe production of gas is very important. There are different other research ideas proposed by different people on wireless communication for robot industry. V.Abilash, J.Paul Chandra kumar, arduino microcontroller is employed in this robot. The robot system is embedded with metal detector capable of sensing the landmine and buzzer from producing a warning alarm to the nearby personnel in that area [1].Yanhuan Zhu, Xin Wang* and Bo Xu, vision based obstacle recognition algorithm are studied based on visual sensors specifically for the unique features owned by high voltage [2].Junichi fukuda, masashi konyo, eijiro takeuchi, remote robotic explorations of collapsed building in a severe disaster are demanded. It is used active scope camera (asc) this main advantages for the vertical exploration such as a light and flexible continuum body to produce distributed driving forces [3]. Aksel A.Transeth, loading of hanging trolleys on overhead is fisher information matix is used to qualify the information context from each image fracture [4]. Swetha N, the idea is to design a robot having a wireless camera mounted on it, so that it can monitor enemy remotely when

required. It can silently enter into enemy area and send us all the information through its many camera eyes [5]. Kenji inoue, taisuke tsurutani, tomohito takubo, tatsuo arai, A robot has six legs, and each foot has a hemispherical shape for hooking on the bar. The robot moves in any direction as commanded by tripod gait; it hangs from the grid-like structure using two sets of three legs alternately. The leg gropes for the bar so as to take as long stroke as possible [6]. Christian Hernandez, raciel poot, lizzel Narvaez, the robot was controlled through the parallel port of the computer with an implementation of arduino + x-bee, resulting that the robot could be guided with a certain freedom and antonomy without using wires[7]. Mario F. M. Campos and Guilherme A. S. Pereira, presents the mobile robot of a mobile robot for autonomous installation and removal of aircraft warning spheres on overhead wires of electric power transmission lines[8]. wang, s. cheng, jianwei zhang and ying hu, A hybrid control method, consisting of a RBF adaptive PD control which was applied to slow-changing subsystem and optimal control which was applied to fast changing subsystem was presented[9].

3. PROPOSED METHOD

The hanging robot is mainly using in industrial purpose and also in petroleum industry. The data can be collected and controlled through ZigBee without human help. If the gas and temperature sensor value increases it send the alert signal to the buzzer and also it will measure light intensity using LDR sensor incase of fire. This have a safety setup for stopping the gas flowing and cooling fan if the values changes in sensors means precaution steps will be taken automatically.

3.1 Block Diagram

Function of the block diagram is shown in fig 1 and 2 and the system consists of various electronic parts. The system includes the robot, Arduino UNO microcontroller, gas sensor, temperature sensor, LDR sensor, buzzer for security alert, dc motor for actuation, ZigBee for controlling through PC, RF for wireless communication, cooling fan. These components are placed on the robot and the power is supplied to the help of power supply unit. PC is used for collecting the data and the direction control is programmed.

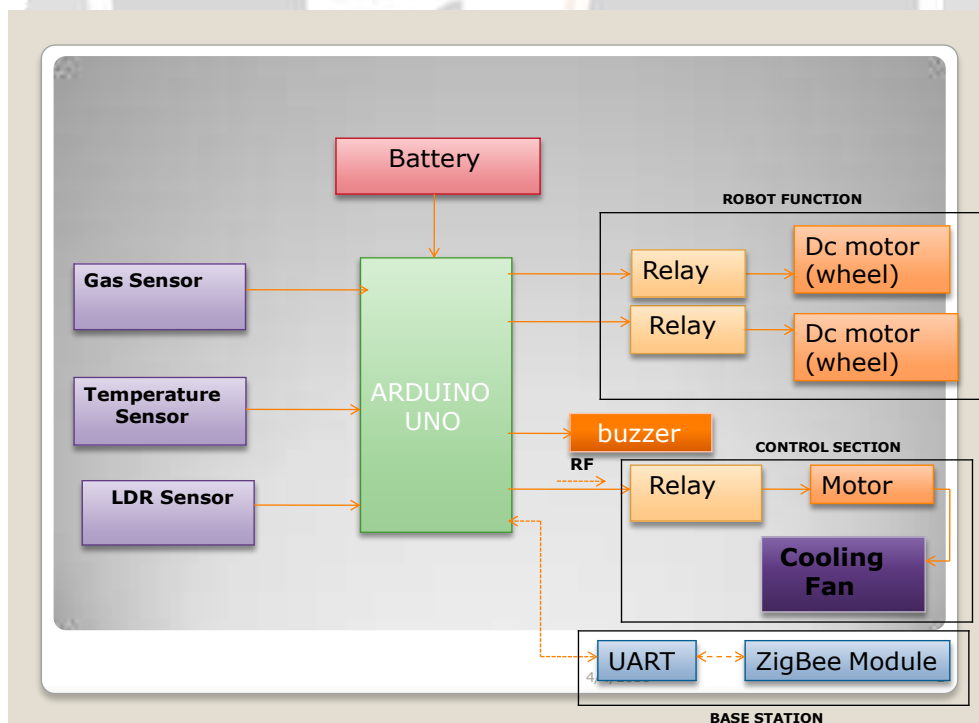


Fig.1. transmission section of the robot

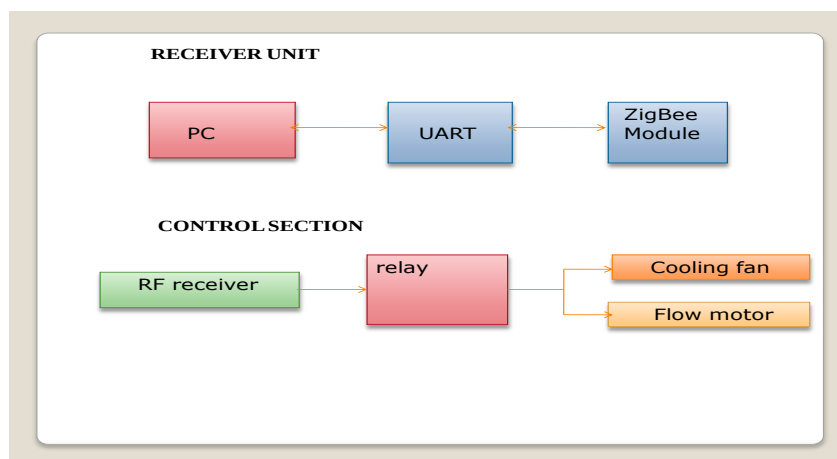


Fig.2. receiving section of the robot

3.1.1 Arduino Microcontroller

ARDUINO Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins of which can be used as PWM outputs, 6 analog inputs. The 14 digital input/output pins can be used as input or output pins by using `pinMode()`, `digitalRead()` and `digitalWrite()` function in ARDUINO programming. Each pins operate at 5v.



Fig.3. Arduino Uno ATmega328 board

The ARDUINO UNO board work in this project, it is able to read inputs light on a sensor and collect the data from sensor with the help of robot, that data can be send to the pc through ZigBee. Any abnormal changes in happen immediately data will be passed and alert the signal using buzzer. The controller is programmed via the TX,RX pins connected to the USB to serial controller and contains boot loader code. It can also be programmed directly via the ICPS pin.

3.1.2 Gas Sensor

The MQ2 smoke sensor is sensitive to smoke and following gases are LPG, Butane, Methane, Alcohol, and Hydrogen. The voltage that sensor outputs changes accordingly to the smoke/gas level that exists in the atmosphere. The sensor outputs a voltage that is proportional to the concentration of smoke/gas.



Fig.4 MQ2 smoke sensor

The output can be an analog signal (A0) that can be read with an analog input of the Arduino or digital outputs (D0) that can be read with digital input of the ARDUINO.

3.1.3 Temperature Sensor:

The LM35 series are precision integrated circuit temperature devices with an output voltage linearly proportional to the centigrade temperature. It is latter group measures temperature, we are used in this temperature because, distance and often are used in hazardous environments.

3.1.4 Ldr Sensor:

The NSL-19M51 is a light dependent resistor with sensitivity in the visible light is region. The photoconductive cell is on a TO-18 ceramic and the photocell surface plastic encapsulated for moisture resistance. Operating voltage is 5v and 39 to 41 degree Celsius intensity of output



Fig.5 connection of sensors with ARDUINO

3.1.5 Buzzer:

A buzzer is an audio signaling device. A Piezo electric buzzer can be driven by an oscillating electronic circuit or other audio signal source. A click, beep or ring can indicate that a button has been pressed. In this project we are using the buzzers can receive the signal from ARDUINO, any immediately alert signal should be on. It is used for security purpose for industry, house and important areas. If the alert signal to transmit all the base station.



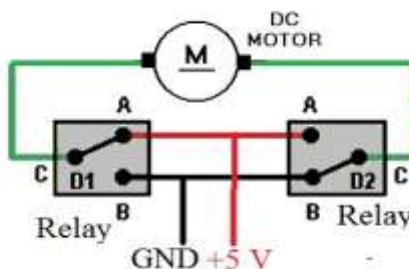
Fig.6 Buzzer

3.1.6 Dc Motor:

A motor drive is a device or group of devices that device can be control with relay using arduino microcontroller. The motor driver used for robot move and provide speed control of the directions. All the flatted areas also move this robot with the help of dc motor wheel using arduino.

A good way, to drive dc motor, is use an L9110 like catsberry 2. L9110 can drive 5v and max 800 Ma DC motor. To drive DC motors with different voltages and currents I designed a h-bridge with a relay board.

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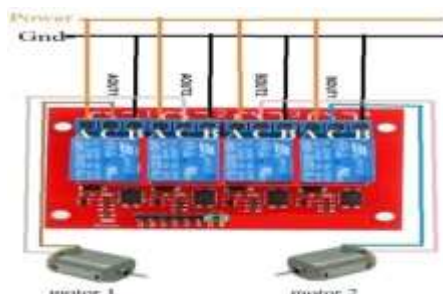


Fig.7 H-Bridge relay with DC motor

3.1.7 RF Tx and Rx

Basically the RF modules are 433 MHz RF transmitter and receiver modules. In the project, RF transmitter is wireless connection with ARDUINO to relay, RF receive the data from ARDUINO to transmit the signal to relay that can be functioned by dc motor. Any abnormal changes can happen in the industry immediately motor is stopped and cooling fan are generated.



Fig.8 RF TX and RX

3.1.8 ZigBee RX:

ZigBee is a mesh network specification for low power wireless local area network (WLANs) that cover a large area. A ZigBee RF4CE PAN is composed of two types of devices: a target device (or node) and a controller device (or node). Target device of this work can compatibility with the network on right way to start the function and controller device is paired with network to target by the devices. We are used controller device, that device control the direction of the robot paired on target device. It can be collected the data through UART from ARDUINO.

Working Principle of ZigBee Module

- The boards feature serial communications interfaces. Sensors are interfaced to ARDUINO board which transmits the data collected to the control room through ZIG-BEE module.
- The control room PC is paired with ZIG-BEE module. The ZIG-BEE module in the control room acts as a receiver. The control room PC is designed with Proteus interface.

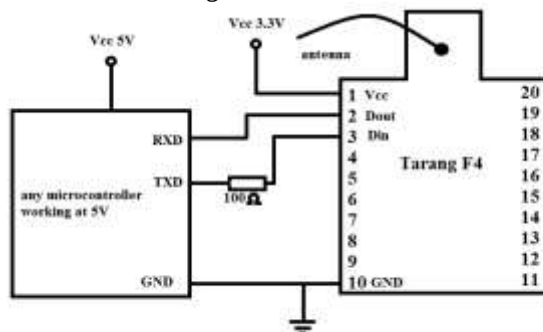


Fig.9 Interfacing of ZigBee module

- The interface consists of button option, whenever a button is pressed the corresponding instructions are carried from the control room to the robot through ZIG-BEE module without human work using already directly programmed in ARDUINO microcontroller.
- The robot executes the instructions.
- When the robot moves forward and similarly for the reverse direction automatically followed by algorithm.
- Every one sec all the sensors readings are collected and corresponding data are shown respective to the sensor readings.

4. RESULTS

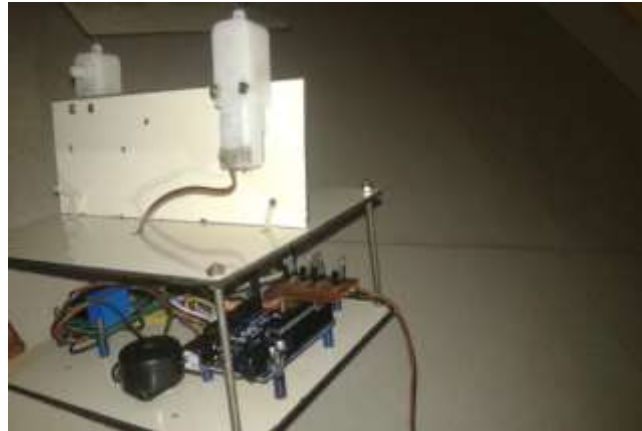
4.1 Hardware Design of Robot



(a) Top view of the sensors connection



(b) Front view of the hanging robot with power supply



(c) Side view of the robot controlled by ARDUINO

Fig.9 Upper level of the hanging robot (a), (b) and (c)



Fig.10 lower level of the control section



Fig.11 Interfacing local system with zigbee

Arduino Program

```

Void setup ()
{
  Serial.begin (9600);
  pinMode (6, OUTPUT);
  pinMode (A0, INPUT);
  pinMode (A2, INPUT);
  pinMode (A4, INPUT);
}
void loop()
{
  Int ld;
  float g, temp;
  ld=analogRead(A4);
  g=analogRead (A0);
  Temp=analogRead (A2);
  Temp=temp/2;

  Serial.print ("LDR :");
  Serial.print (ld);
  Serial.println ();
  Serial.print ("gas :");
  Serial.print (g);
  Serial.println ();
  Serial.print ("temp :");
  Serial.print (temp);
  Serial.println ();
  Delay (1000);

  if ((temp>40)|| (g>275)|| (ld>500))
  {
    digitalWrite (6, 1);
  }
  else
  {
    digitalWrite (6, 0);
  }
}

```

5. CONCLUSION

In our work we have implement a simple and cost effective robot, which is multi-purpose of the ARDUINO controlled robot in nature. Mainly it is designed for uses of gas and petroleum industry. This robot can be travelled with help of rope using dc motor through ARDUINO, can be controlled by wireless network of ZigBee module with base station. It is used hazardous environment.

6. REFERENCES

[1] V.Abilesh, J.Paul Chandra kumar, "Arduino controlled landmine detection robot", IJESC @ may 2017.

- [2] Yanhuan zhu, xin wang* and bo xu.”Design of vision-based obstacle crossing of high-voltage line inspection robot”, IEEE international conference on cyber technology in automation, control and intelligent systems June 19-22, 2016.
- [3] Junichi fukuda, masashi konyo, eijiro takeuchi, and satoshi tadokoro “remote vertical exploration by active scope camera into collapsed buildings”, transactions on systems, man, and cybernetics: systems, 2016.
- [4] Aksel a. traneth applied cybernetics sintef ict, “loading of hanging trolleys on overhead conveyor with industrial robots”, IEEE transactions on systems ©2015 IEEE.
- [5] Swetha N, “design and implementation of acceleratoer based robot motion and speed control with obstacle detection”, IJSETR, March, 2013.
- [6] Kenji inoue, taisuke tsurutani, tomohito takubo, tatsuo arai, “omni-directional gait of limb mechanism robot hanging from grid-like structure”, international conference on intelligent robots and systems, 2014.
- [7] Christian Hernandez, reciel robot, lizzel Narvaez, “design and implementation of a system of a system for wireless control of a robot” IJCSI, September 2010.
- [8] Mario f. m. campos, member, IEEE, guilherme a. s. Pereira, member,”a robot for installation and removal of aircraft warning spheres on aerial power transmission lines”, IEEE, IEEE transactions on power delivery february 21 - 26, 2009.
- [9] Wang, s. cheng, jianwei zhang and ying hu, “control of a redundantly actuated power line inspection based-on a singular perturbation model”, IEEE international conference on robotics andbiomimetics, bangkok, Thailand, Feb. 21-26, 2009.

