Hand Gesture Control Robot for Fire Detection and Prevention

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Abstract:

Detecting a forest fire in a dense region is challenging and cannot be undone in a small time-span. This paper is mainly indulged with the hand gesture control and fire density detection in a bot. The extensive simulation with both microcontroller and flame sensor will give the intensity of the fire in the forest area. In comparing with the other approaches, our research gives the exact intensity of the fire and more than 75% accurate. It is also integrated with the hand gesture control using Zigbee Protocol accordance will give the movements in the Robot. The arm is also equipped with the sensors to facilitate the temperature and condition parameters. Further this approach can be extended up to defence applications in military.

Keywords: Hand Gesture Control, Fire Detection, Zigbee Protocol, Arduino.

1. Introduction

Robotics is an emerging technology and used almost in all fields such as military, medical, construction, manufacturing etc. The development of elementary robots such as line follower robot, computer controlled robot keen the development of accelerometer established gesture control robot with Zigbee protocol [1,2]. The gesture controlled robot is meticulously controlled with the help of hand like buttons or joystick in other method, based on the hand movements the robot is controlled. The hand consists of RF Transmitter and accelerometer for transmitting the control signal to the robot. The transmitter communicates the control signals to the robot for moving reverse, forward, turning left, turning right and stops for the required action. The aforementioned tasks are accomplished with the hand gesture [3,4]. The present research makes an opportunity for the learners to interact directly with the consumer electronic devices, which is a new level of experience to the user. The present gesture control skill will be the replacement to the old technology and hence it further reduces the overall system complexity.

Primarily the technology is deliberated in the gaming field (like Xbox Kinect), but the solicitation to control motion/gesture technology are additional different if it is used in other electronics like televisions, computers, etc., for our day to day applications like selecting, scrolling, clicking etc.

2. System Description

A. Existing System

There are two components where the main component receives the input from the MPU6050 Accelerometer Gyro Sensor with Arduino. The Arduino microcontroller is continuously collecting the MPU6050 information on the basis of the pre-defined requirements, it is transmitting information to the RF Transmitter. The wireless networking between the RF Receiver and RF Transmitter is yet another aspect of the module. Upon receiving the information via Arduino (through the Encoder IC),

the RF Transmitter transfers it to the RF Receiver via the RF Interface. The Gesture regulated robot transports due to the transmitter in the hand, based on arm movement. When the front hand is rotated, the robot begins pushing forward and continues to move forward until the next command is made. The disadvantages are negatively affects energy-efficiency, reliability, and the operational lifetime of the kit altogether. Once it gets exploded cannot be reused.

B. Proposed System

The probability of the fire accident in any remote area or in any industry takes place very often. For example, in cotton mills, garments godowns and fuel storage tanks, even the electric leakages can cause immense fire & harm. In the vilest scenarios, the fire accident results huge sufferers interns of financially and by lives of living things. The unmanned aerial vehicle is the best way of protecting people's lives, resources and environment. Here a firefighting robotic device is equipped with an integrated device. It has the ability to navigate independently on a modelled surface, and constantly searches the fire flame. The robot also has a route guide as an emergency relief in the fireplace system or in normal situation. Before the fire might spread out of sight and reach, the robot is detailed sufficiently to search the drenches and flames.

3. Module Description

A. Architecture of fire detection system

Fig.1 displays the fire warning system architecture. The Arduino Uno microcontroller board is mounted upon this ATmega328P. The microcontroller contains 14 i/o pins (6 for PWM outputs), 6 analog inputs, a USB connection, a 16 MHz crystal, an ICSP bridge, and a reset button. It helps the microcontroller by directly installing it to a device via a USB cable or powered by an AC-DC adapter or switch-on battery.
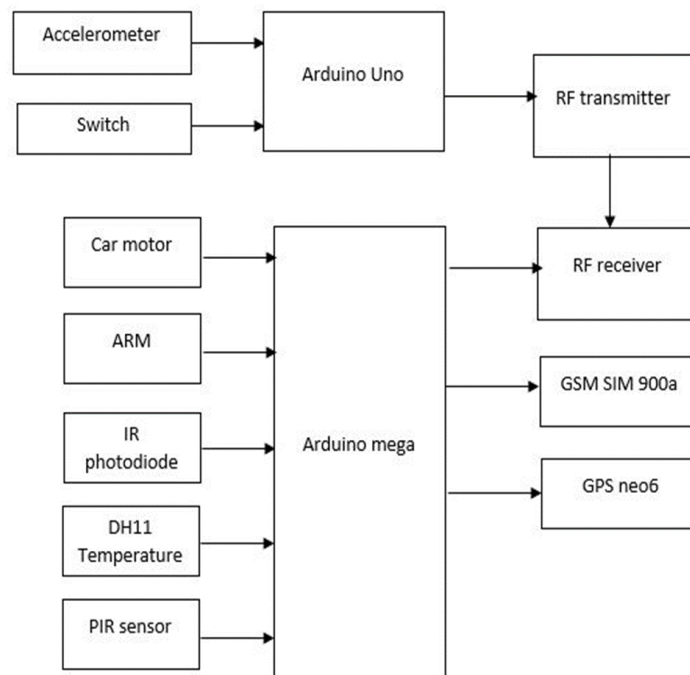

Fig.1 Architecture of the fire detection system

The GPS elements are normally used in fleet management system, smart phones, military etc., for chasing or verdict location. The satellite-based Global Positioning System (GPS) use satellites and ground stations for measuring and computing a particular location on Earth.

A DC motor is somewhat motor which belongs to the class of electrical machines where the direct electrical current/power is transformed into mechanical power. Frequently, these motor depends on

forces that magnetic field induce. Irrespective of the type, DC motors have some internal mechanism, which is electronic or electromechanical.

ZigBee transmitter consists of five blocks viz.: CRC, Symbol-to-Chip, Bit-to-Symbol, O-QPSK Modulator and Pulse shaping. The CRC is designed over the data of MHR and MFR payloads of MAC layer. The output of the CRC block is served to the input of Bit-to-Symbol block.

The IR flame detector has three sensors, which is sensitive to a various frequency of radiation, individually. The IR emission radiated by a characteristic hydrocarbon fire is additional intense at the wavelength established by a sensor than the others.

B. Methodology

The Gesture controlled robot passages rendering to hand movement as transmitter is placed in the hand. When the hand is tilted front side, the robot moves forward and moving forward continuously until the subsequent command is issued.

When the hand is tilted in backward direction, the robot transforms the state and initiates the moving in backwards path until a new command is issued. When we tilt it in left side Robot get turn left till next command. When the hand is tilted in right side, the robot rotated to right and for stopping the robot by making the hand stable.

In transmitter portion an accelerometer and a RF transmitter element is used. The accelerometer provides an analog output signal and need to be converted the analog signal to a digital data (ADC). The 4-channel comparator circuit is used for ADC conversion. By changing the reference voltage, the corresponding digital data is generated from the ADC, apply the data to HT12E encoder to encrypt the data or translating into a serial form and transmit the data with the help of RF transmitter into the environment. On the receiver side the RF receiver is used to receive the data, fed to HT12D decoder. The decoder IC transforms the received serial data to parallel, which can be read with the Arduino. Conferring with the received data, the robot is driven by two DC motor in reverse, forward, left, right and stop direction.

4. Results and Discussions

ZigBee module is placed in both in hand glove and Bot. The transmitter will be placed in the hand glove and the receiver is placed in the bot. According to the movements in the hand glove the bot will respond to that. The fire flame sensor which is placed in the bot will detect the intensity of the fire in the remote area. Arduino UNO will control the actions of the sensor and act as the CPU. Fig.2 shows the hardware circuitry of the fire detection alert by the bot.

Fig.2 Fire detection alert by the bot

5. Conclusion

The Robotics is the finest method to safeguard the human lives, wealth and surroundings. A Firefighting robot is intended and built by an embedded system. The capability of navigation alone over a modelled floor and scans the fire flames vigorously. The robot act as a route guide with a fireplace device or in normal case it act as an emergency device. The robot is intended for searching

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douses & fire, before the fire is extent out of control and range. The human involvement is very less and in most of the development is automatic. The present approach can able to diminish the quantity of human labour as well as the detection of fire in the inaccessible area.

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