

Intelligent Drone for Industrial Inspection(UAV)

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Abstract : Our paper is subjected to Real-Time Monitoring System for preventing the calamities in Industries using UAV (Unmanned Aerial Vehicle). Now-a-days, Industries are prone to calamities. Even if any explosion occurs due to leakages, it can't be easily known to the manual workers and it may cause explosions. So in order to avoid this, we have developed a mobility assistive drone. Drone is allowed to monitor the ambient situations using surveillance Pi camera and exact location of leakages is also detected. Toxic gas like CO is sensed using the MQ-7 sensor and the sensed data are transmitted from Raspberry Pi 3 to Monitor through Wi-Fi. If any gas leakage is detected, then two levels of alert will be given. By this the human intervention can be avoided inside the industry and the calamities can be prevented.

IndexTerms - Raspberry Pi 3, MQ-7 sensor, UAV, Drone, CO, Wi-Fi.

I. INTRODUCTION

In the harmful working environment, human safety is vital. Coal mines is a place in which human lives are more dangerous and many workers are injured due to explosions and leakage of toxic gases. Fire calamities can also happen. At the same time if any person is absent in an important place for monitoring, it may also cause serious risks. At present many systems are implemented in industrial areas but still those calamities are occurring.

A drone is designed and that is allowed to enter into the industrial area. The drone will be equipped with MQ7-gas sensor for detecting the toxic gas like CO. The drone used must be a flame-proof so that even if any calamity occurs it will transmit the information to the receiver without fail. Also, it must be designed to work in the high temperature situations. A Pi camera is also interfaced with the drone which will give a live video of the environment and this video is transmitted to the monitor or mobile phone to the user who is controlling the drone by means of Wi-Fi technology. If leakage occurs means an alert will be given to the nearby workers through buzzer and in the serious situation alert will be given to Fire Service through call.

Wireless communication is also an important issue inside the industry. Usage of wired technologies are not worthy as the cables will get damaged after a certain period of time or due to some environmental factors. So the wireless transmission technology is preferred. The industrial monitoring protocol should be designed such that the system must have a reliable end to end data delivery.

The data which is collected from the drone should be transmitted without any delay and loss of data. Some of the techniques like ZigBee, Bluetooth have a small range and the data rate is minimum when compared to Wi-Fi. So using Wi-Fi the data can be transmitted to a wide range with a high data rate of 54Mbps.

II. HARDWARE IMPLEMENTATION

The Raspberry pi 3 microprocessor is used since this is compact in size and the power consumption is too Low. Raspberry Pi 3 board is selected because it is fast when compared to the earlier versions. Many sensors or peripherals can be interfaced with it at the same time and can work very fast as the quad core processor is used in it. This processor allows us to interface many modules at a time. It has 26 GPIO pins, two 3.3V pins, two 5v pins, eight ground pins and two I2C pins. It has 4 USB ports also which allows us to connect the Pi camera, Wi-Fi module etc. The gas sensor used here is MQ-7. It is used to sense the gas data of the industry. This sensor is connected with the GPIO pins through ADC Convertor (MCP3008). MQ-7 gas sensor is used in order to sense the gas leakage in the industrial areas. A gas sensor is for detecting the combustible, flammable and the toxic gases. The MQ-7 sensor mainly detects the CO gas which is most emitted in coal mining areas.

The voltage required is 3.3V which is provided from the GPIO pin. In the gas sensor, H-pins are allowed to heat for a while so that it can detect the gas. Once the gas is detected, an alert is given to the workers within the industry. If it became threat to workers, then it will give alert call to the fire service. A normal Pi camera is connected to the board. The Pi camera captures and sends the live video signal to the receiver. It has a coverage area of 150 feet. The data transmission rate is about 54Mbps. So the live video can be transmitted without any delay.

The Raspberry Pi 3 is placed on the Quadcopter. It is given power through 11.1V rechargeable battery and has 935KV motor, propeller, Electronic Speed Controller, Flight Controller, Transmitter and Receiver.

III. SOFTWARE IMPLEMENTATION

The raspbian os is used in the raspberry pi 3 board. it is a free operating system that is based on debian which is particularly optimized for the raspberry pi 3 hardware. it comes with over 35,000 pack pages and pre-compiled software bundled in a simple format for easy installation in the raspberry pi 3. the coding for all the sensors and the drone movement are done using the python coding. python is preferred since it is a simple and interpreted language. it is also free and open source software. this can be used in many platforms such as linux, ubuntu etc. also, it supports procedure-oriented programming as well as oops. the web browser is created by using html. the static ip address should be configured in the raspberry pi for the wi-fi module. this assigned static ip address is for connecting with the wi-fi of the mobile phone for displaying the window of raspberry pi 3. since a normal pi camera is used it must be initially interfaced in the raspberry pi 3 board using the linux commands. the quadcopter motion is configured using the open pilot software.

V. PROPOSED WORK

The Raspberry Pi 3 board is placed above the Drone. The Raspberry Pi 3 board is given a power supply of about 5V. The sensors which are connected are given power through the GPIO pins. A Pi camera is fixed in the Raspberry Pi 3. The camera will capture the industrial environment and the transmitted live video will be streamed through monitor and social media. The alert is given to workers through buzzer and call in case of any emergency. The Wi-Fi module in the Raspberry Pi 3 must be tethered with our mobile phone using the username and password. After tethering, VNC (Virtual Network Computing) should be opened and the static IP address must be given and the user name and the password of the Raspberry Pi 3 are typed. After authenticating, the Pi window will be opened automatically and the system starts to sense the gas leakage. The drone is controlled via Remote control. It is given power through 2200mah rechargeable battery. The transmitter and receiver sends the position of the drone. The Flight and Electronic Speed Controller controls the motion of the propeller.

VI. ALGORITHM

- Step 1: Connect Ethernet Cable with Raspberry Pi 3.
- Step 2: Configure Raspberry Pi 3 using Putty Configuration.
- Step 3: Enable portable Wi-Fi hotspot in the mobile phone.
- Step 4: Connect the Wi-Fi by giving the username and password.
- Step 5: After tethering, open VNC (Virtual Network Computing) Viewer and the static IP address which is configured should be given.
- Step 6: Raspberry Pi 3 will be opened.
- Step 7: Give the following username and password
 - username: pi
 - password: raspberry
 - (Raspberry Pi 3 window will be opened)
- Step 8: Menu > Preference > Raspberry Pi Configuration > Interfaces > Boot.
- Step 9: Execute the code.
- Step 10: Alert is given through Buzzer and Call.
- Step 11: Test the Quadcopter(Drone) with the remote control.
- Step 12: Place the kit in the Quadcopter and allow to monitor the industrial environment.

VII. LITERATURE SURVEY

The former collected data exposes that large number of accidents occurs due to gas accidents, explosives, flood, etc. It involves the development of a system that can help reduce the human and material forfeiture that happens during rescue operations. Thus sensors for detecting the gas are mandatory in the drone to be deployed.

The idea of a Mobile Drone is able to aid the rescue team arriving into industrial environment got picked up with the great raise in the technology. The Drone is used to get in to the calamity sector and rescue operations. The drone can go in to industrial environment and detect gas levels, temperature, gas contents, etc. The information can be sent to controller in safe arena.

VIII. EXPERIMENTAL RESULTS

The following are the experimental results. The Figure-2 shows the connection between Buzzer, Pi Camera & Gas Sensor with Raspberry Pi 3. The gas sensor is given power supply through MCP3008 which is used to convert sensed Analog signal into Digital signal. The Buzzer is used for giving the alert. Pi-camera is fixed in the CSI interface for the live video streaming.

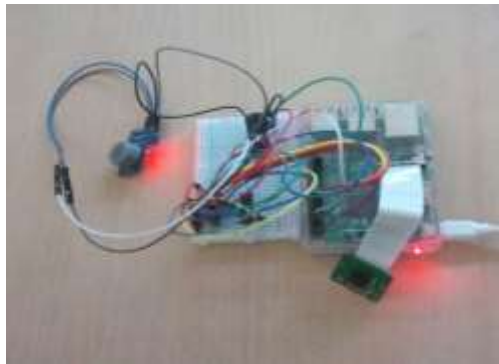


Fig.2 Shows the connection between Buzzer, Pi-Camera & Gas Sensor with Raspberry Pi 3.

The Figure-3 shows the Pi-Camera output. Configure the camera module in the Raspberry Pi 3. Register in YouTube. Open My channel > Video Manager > Live Streaming. Copy the stream key and paste it in the command. Execute the command. After executing, the video will be lively streamed through the YouTube.



Fig.3 Shows the Pi-Camera output.

The Figure-4 shows the alert through call. Configure the Raspberry Pi IP address in mobile phone. Enable the portable Wi-Fi hotspot in mobile. After tethering, give the mobile number in the code to which the alert has to be given. If the gas is sensed, then the alert is given to the registered mobile number via call.



Fig.4 Shows the alert through call.

The Figure-5 shows the setup of Quadcopter and Raspberry Pi 3. The QuadcopterF450 is given power through separate 2200mah rechargeable battery. The attached transmitter and receiver predicts the motion of the Quadcopter. The Electronic Speed and Flight Controller is used to control the propeller. The Controller is configured using Open pilot software. The propellers are given power through 935KV motor.



Fig.5 Shows the setup of Quadcopter and Raspberry Pi 3.

IX. CONCLUSION AND FUTURE WORK

The designed drone is reliable to use and can be used in any working environment. The sensors which are used are so sensitive. The gas sensor will also detect other leakage such as hydrogen, smoke etc. This model can also be used for other purpose also. The work environment can be seen from the controller room itself. Since Wi-Fi is used, the data can be transmitted from any place. The accidents are prevented. This application can be used for all industrial area where human intervention for security can be avoided. In hospitals, shopping malls, etc. also this application can be used. This project can be enhanced by placing a water sprayer, oxygen supplier in the drone. In case of any fire accidents water has to be sprayed at the right place and if anyone is suffocated oxygen will be supplied. Also, some other sensors such as temperature sensor, humidity sensor can be interfaced for further convenience of the workers.

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