Industrial Surveillance Drone

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Abstract

Industrial operations face constant safety and security threats, which require real-time response solutions that provide rapid, precise and reliable situational awareness. Security operations are simplified with pre-defined missions, and emergency response is enhanced through on-demand availability. The drone helps in total surveillance of industry and preventing industrial accidents caused by fire or by any other means. The proposed technology has sensors mounted on it. It uses temperature sensor-DHT11, gas sensor-MQ2, GPS module, Lora module for transmission. GPS is used for knowing the area of damage or area where a gas leakage is occurring. In addition to the security industrial inspection can be done with the help of a camera mounted on drone.

Keyword- Drone, ATmega328P Microcontroller, Temperature Sensor-DHT11, Gas Sensor-MQ2, GPS, Lora Module, Arduino Nano

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I. INTRODUCTION

Industrial operations face constant safety and security threats, which require real-time response solutions that provide rapid, precise and reliable situational awareness. Security operations are simplified with pre-defined missions, and emergency response is enhanced through on-demand availability. Real-time aerial video and photos are delivered directly to personnel on the ground, enabling more informed decision making in times of emergency situations or during routine patrols. The drone helps in total surveillance of industry and preventing industrial accidents caused by fire or by any other means. It uses temperature sensor to sense the temperature and prevent it from any accidents. Areas where humans can't go at high temperature conditions, drones can be used. Gas detector is used to check the presence of gas in that area. Gas leakage can be found out using this drone. GPS module give us the area of problem or damage. It gives the latitude and longitude coordinates of the area so that area can be found out easily. A camera can be used of inspecting.

In today's world, there is a growing need for surveillance in order to maintain the decorum at a place and ensure the safety and security of its people. An aerial surveillance system will be worthwhile in this regard. This system will be a convenient and efficient alternative to current surveillance systems. It can be used in peace keeping activities and also real time monitoring of a place at any time of the day. The aim is to provide fast and efficient surveillance at an affordable rate so that it can be used widely at private, institutional and governmental level.

II. SYSTEM DESCRIPTION

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself (DIY) kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler tool chains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

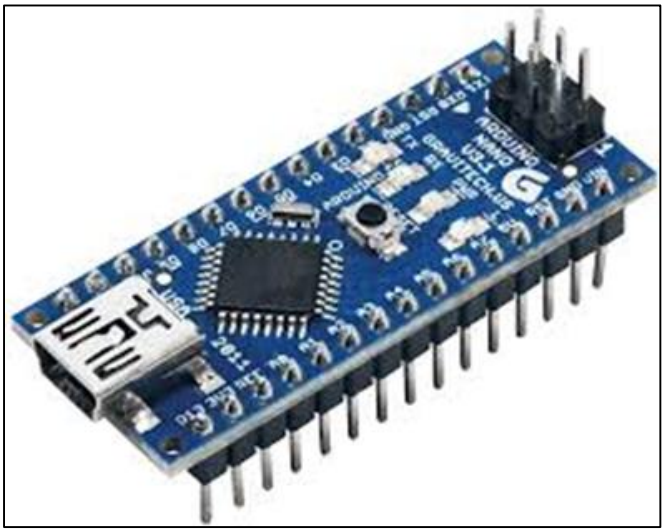

Fig. 1: Arduino Nano

A. Temperature Sensor – DHT11

The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use, but requires careful timing to grab data. The only real downside of this sensor is you can only get new data from it once every 2 seconds, so when using our library, sensor readings can be up to 2 seconds old.

- Low cost
- 3 to 5V power and I/O
- 2.5mA max current use during conversion (while requesting data)
- Good for 20-80% humidity readings with 5% accuracy
- Good for 0-50°C temperature readings ±2°C accuracy
- No more than 1 Hz sampling rate (once every second)
- Body size 15.5mm x 12mm x 5.5mm
- 4 pins with 0.1" spacing

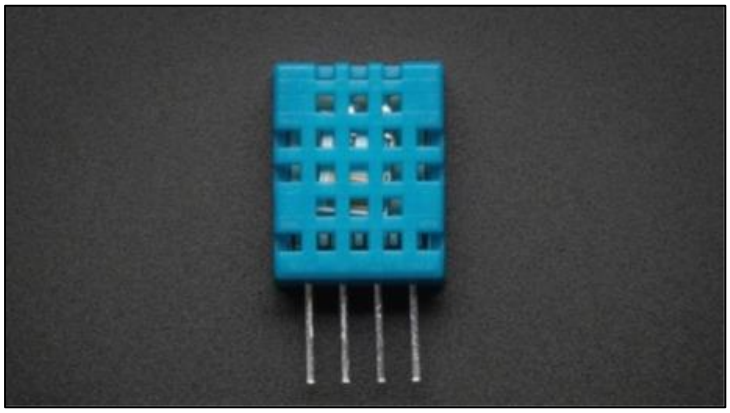

Fig. 2: DHT11

B. Gas Sensor – MQ2

The MQ-2 smoke sensor is sensitive to smoke and to the following flammable gases:

- LPG
- Butane
- Propane
- Methane
- Alcohol
- Hydrogen

The resistance of the sensor is different depending on the type of the gas.

The smoke sensor has a built-in potentiometer that allows you to adjust the sensor sensitivity according to how accurate you want to detect gas.

- The greater the gas concentration, the greater the output voltage.

- The lower the gas concentration, the lower the output voltage.

Fig. 3: MQ2

C. Wireless Module – AI Thinker RA – 02 Lora Module

Developed by Ai-Thinker Company, the manufacturer of the ESP32S, this Ra- 02 LoRa (Long-range Radio) module has communication over a long-range spread spectrum. This form of wireless communication results in a larger bandwidth, increasing interference resistance, minimizing current consumption, and increasing security. This module uses SX1278 IC and works on a 433MHz frequency. Frequency hopping which gives you that sweet balance of quality signal transmission will cover a range of 420-450MHz. This long range wireless capability is packed into a small (17 x 16mm) package and delivered without an antenna. With the LoRa Ra-02, you don't have to compromise in the balance of range, interference immunity, or energy consumption. The technology behind this IC means that it's perfect for long range and strength.

- Wireless Standard: 433MHz
- Frequency range: 420 - 450MHz
- Port: SPI/GPIO
- Operating Voltage: 1.8 - 3.7V, default 3.3V
- Working Current, receive: less than 10.8mA (LnaBoost closed, Band 1) transmit: less than 120mA (+20dBm), Sleep model: 0.2uA
- Working temperature: -40- +85 degrees
- Pin pitch: 2.0 mm

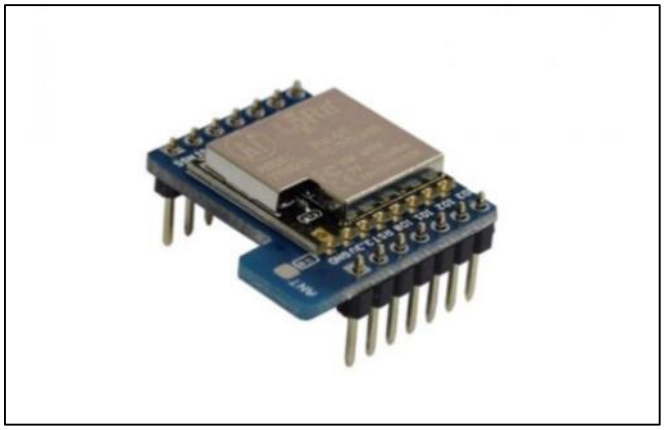

Fig. 4: LORA module

D. GPS – UBLOX NEO 6M

The NEO-6 module series is a family of stand-alone GPS receivers featuring the high performance 6 positioning engine. These flexible and cost effective receivers offer numerous connectivity options in a miniature 16 x 12.2 x 2.4 mm package. Their compact architecture and power and memory options make NEO-6 modules ideal for battery operated mobile devices with very strict cost and space constraints.

Fig. 5: GPS

E. LCD

The Liquid Crystal Library allows you to control LCD displays that are compatible with the Hitachi HD44780 driver. There are many of them out there, and you can usually tell them by the 16-pin interface.

Fig. 6: LCD

III. PROPOSED SYSTEM DIAGRAM

A. Drone Circuitry

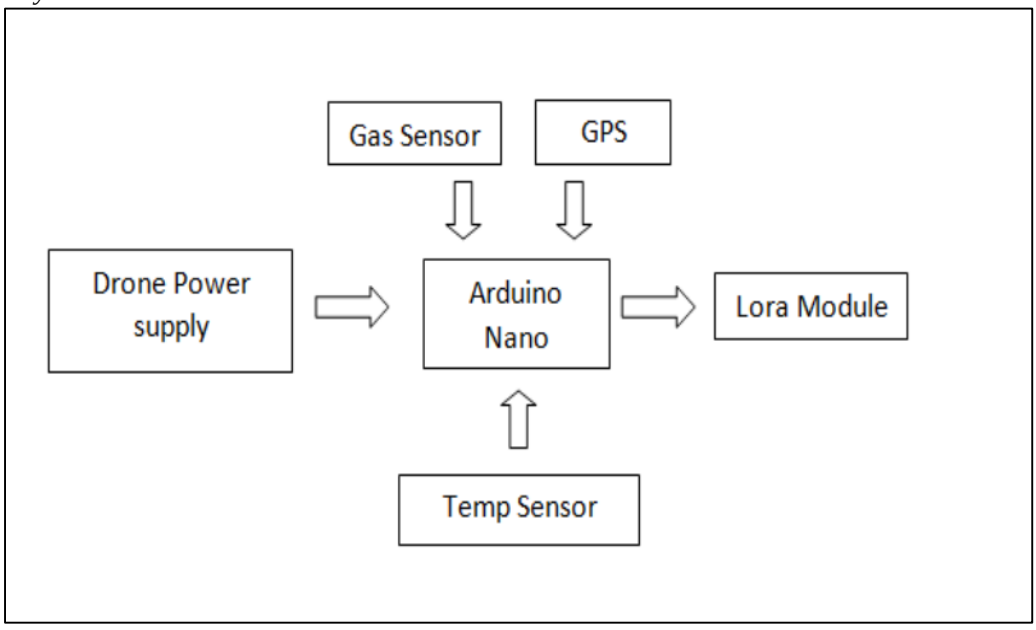

Fig. 7: Drone Circuitry

The supply for the Arduino Nano is taken from the drone itself. Gas sensor is mounted on drone to check whether any gas leakage is occurring in the industry. Temperature sensor sense the temperature change in the industry or for a particular machinery and the change can be notified. GPS module gives the exact location of problem or damage. It include both latitude and longitude coordinates of the system area. The information output of all the sensors are transmitted using a LORA module. It has a good transmission range so that it is more convenient in usage.

B. Controller Circuitry

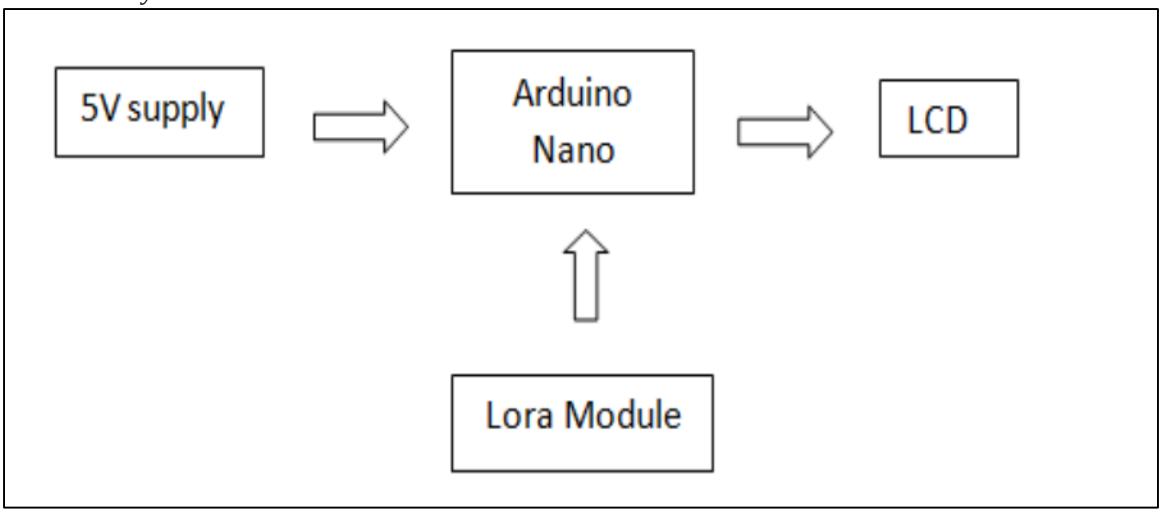

Fig. 8: Controller Circuitry

The Arduino Nano is supplied by a 5V supply. LORA module is used for receiving the information from drone. The LCD displays the temperature level, gas level & the location.

IV. CONCLUSION

Our project can be further expanded. We can incorporate collision avoidance in our Aerial Surveillance System. This can be done by using Infrared sensors to detect obstacles. Thus our Aerial Surveillance System will be able to make its path through the hindrances and reach the destination quickly. This project can also be used for other services rather than surveillance. For example, it can be used to carry light weight objects from one place to another thus ensuring faster delivery. We can send first aid to victims with the help of drones. As a result, the first aid will arrive flying to the victim in no time, while the ambulance is on its way thus saving every minute that is crucial for the victim's life. The doctor will be able to see the victim through our video and also give instructions through the alarm or audio system that plays messages. We believe our project has a lot of potential in benefitting humanity.

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REFERENCE

[1] Malatone Bouasym, "USCG Search and Rescue Drone". Engineering Technology Capstone Project. Spring 2015.

[2] Kenzo NANOMI, "Prospect and Recent Research & Development for Civil Use Autonomous Unmanned Aircraft as UAV & MAV". Journal of System Design and Dynamics, Vol.1, No. 2, 2007.

[3] Richard M. Thompson II," Drones in Domestic Surveillance Operations: Fourth Amendment Implications and Legislative Responses," Congressional Research Service 7-5700 www.crs.gov R42701, April 3, 2013