FIRE FIGHTING ROBOTS TO AVOID FIRE IN FOREST ENVIORMENT

Selvarani A, Surendira Kumar N, Surya Narayanan Gj, Sunil Kumar A S
Department of Electronics and communication Engineering,
Panimalar Engineering college, Panimalar Institute of Technology,
Poonamallee, Chennai, Tamil Nadu 600123, India.

ABSTRACT

In this paper, we propose robot to enable dynamic tracking of hazardous airborne plumes using Internet of Things (IoT) sensor platforms. The robot with sensors, emergency response teams may keep safe distances during hazard identification, reducing first responder exposure. Furthermore, we combine sensor-based particulate identification with autonomous drone flight control to dynamically identify and track the limits of aerial plumes in real time. This allows first responders to visually observe plume movement, allowing them to better predict and localise the impact region.

Keywords—path planning; mobile robot; forestry; filed robot; forest fire monitoring; fire front; remote sensing;

INTRODUCTION

Flames are often visible when they have spread over a large area, making control and extinguishment difficult. As a result, human and material resources are lost, and the earth and air are harmed. The fire may start as a result of human activities such as smoking or barbecue parties, or as a result of natural causes such as extremely high temperatures during the summer season, or there may be a shattered glass that acts as a focal point, concentrating the sunlight on a small area for an extended period of time, prompting fire-starting. When a fire starts, combustible materials in the surrounding area act as fuel, causing larger and wider fires. Early discovery of a fire can considerably reduce the potential for harm as well as the cost of fire fighting. Predict and localise the area of effect.. For an autonomous mobile robot to operate in a forested region, effective path planning is necessary. In a natural forest setting, there are many barriers and a complex topography. Despite being human. When beings travel through these conditions, they will choose a path that is simple to follow visually before moving. Some methods use the load required for robot movement as a cost while calculating the optimum route using geometrical data. These techniques essentially involve avoiding obstacles, and they are helpful in uncomplicated environments with few obstacles, like indoors.

However, the usual method does not suited to a complicated environment, such as a natural forest area, because the moveable areas are confined and it becomes difficult to watch a large range when attempting to avoid all the obstacles. Additionally, the possibility of a path with a substantial detour may result in an increase in the amount of time and energy needed to move to the destination. The robot is able to move through regions with minimal vegetation to knock down barriers. It is anticipated that the path will be created with the grassy space in mind.

EXISTING SYSTEM

In this robot there were much demerits like in this we were used Bluetooth whose range is not much more.so the was a need of manual effort to control the robot but the man should be in range .if by chance there is loss of connection between robot and human so the robot will not be able to controlled.

DISADVANTAGES

- ✓ Forest fire can't be detected in dense forest.
- ✓ Animal life will be in danger.

PROPOSED SYSTEM

The primary goal of the research is to identify anonyms fire in the forest and arrest it as soon as possible, We are introducing the robot which will monitor the temperature and gas of the environment if any abnormal gas or fire gets detected, it will forward the data to the forest ranger office through Zigbee and then the data will be updated to the IOT server and if the temperature level goes high more than the threshold value, water pump is activated which will pump the water available in the tank which will be fixed in the robot and PIR sensor will be added to the robot will monitor human activity late at night, and data will be transmitted and updated on the server.

ADVANTAGES

- ✓ Dense forest can be maintained.
- ✓ Living organism is protected from natural disaster

BLOCK DIAGRAM

ROBOT SECTION-:

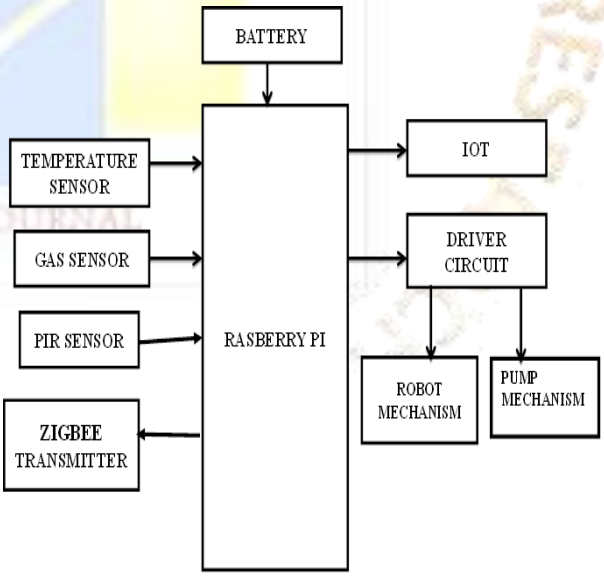


Figure 1- Block diagram

MONITORING SECTION:

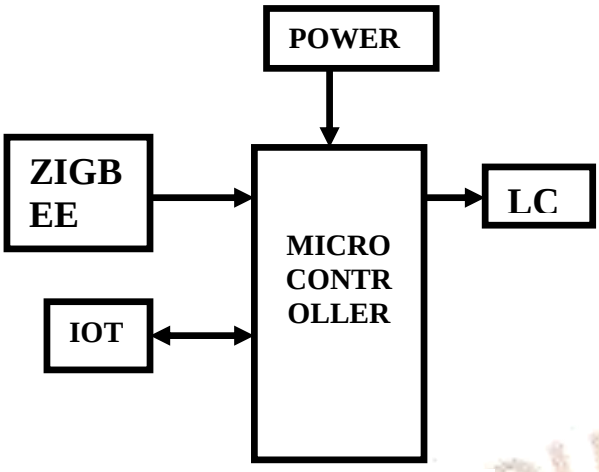


Figure 1 monitoring

LITERATURE SURVEY

COOPERATIVE FOREST MONITORING AND FIRE DETECTION USING A TEAM OF UAVS-UGVS

This paper investigates forest monitoring and fire detection strategies using a team of unmanned aerial vehicles (UAVs) and unmanned ground vehicles (UGVs). UAVs have great advantages in forest fire detection and fighting. However they have limited running time and payload capabilities, therefore UGVs are paired with UAVs to avoid their demerits. First, UGVs are used to transport the UAVs to the nearest location to their assigned search area. The UAVs will take-off and start the monitoring and search mission. When one of the UAVs detects the fire, it sends the fire spot coordinates to the leader UGV and ground fire management personnel. Then, the leader UGV that has a powerful computing and image processing capabilities will generate the reference trajectory for UAVs to follow in order to detect and continuously monitor the fire spread. Simulation results are presented in order to demonstrate the effectiveness of the proposed algorithm.

AUTHOR: Khaled A. Ghamry; Mohamed A. Kamel; Youmin Zhang

A STUDY ON PATH PLANNING FOR SMALL MOBILE ROBOT TO MOVE IN FOREST AREA

We are developing an autonomous monitoring system using mobile robot in response to the demands of autonomous monitoring in forest area. The effective path planning is required for autonomous operation. The robot needs to locomote in the grassy area so as to move in a natural forest area, therefore the path route on grassy area have to be considered. The objective of this study was to develop a path planning method for small mobile robot to move in the forest. We focused on the cost used to generate the path and try to add grass vegetation into the cost map. The grass vegetation degree is effective to generate the optimal path, and the robot could move in forest by following the generated path.

AUTHOR:K. Tanaka; Y. Okamoto; H. Ishii; D. Kuroiwa; H. Yokoyama; S. Inoue; Q. Shi; S. Okabayashi; Y. Sugahara; A. Takanishi

FIRE-FRONT RECOGNITION IN UAV-BASED FOREST-FIRE MONITORING SYSTEM USING FUZZY ROUGH SOFT SETS

This work describes a new method to recognize the forest-fire front based on uncertain observations in a forest fire-fighting monitoring system, which jointly uses UAVs and remote sensing. A method of the fire front representation based on soft fuzzy rough level sets is proposed, the required image processing and remote sensing algorithms are presented. The proposed method has acceptable computational complexity in a real-time forest fire response decision support system.

AUTHOR: Vladimir Sherstjuk; Maryna Zharikova

A SOLUTION FOR SEARCHING AND MONITORING FOREST FIRES BASED ON MULTIPLE UAVS

Forest fires usually appear in complicated terrain, as a result, ground vehicles are obviously inaccessible to these fire areas. In recent years, Unmanned Aerial Vehicles (UAVs) have been paid increasing attention and become a very promising solution to forest fires searching and monitoring. This paper explores the application of UAVs in the wild forest fires searching and fire frontier monitoring mission. First, the FARSITE fire model is used to simulate the realistic wild fire behavior. After that, the fire search problem is solved with Genetic Algorithm (GA). Then, a cooperative fire monitoring algorithm is investigated. Finally, simulation results show the effectiveness of the proposed searching and monitoring methods.

AUTHOR: Yintao Zhang; Youmin Zhang; Ziquan Yu

COMPONENTS REQUIRED:

A. RASPBERRY PI 3 B+

• The model B+ outperforms in terms of processing speed and wireless capability, with dual-band WiFi 802.11ac running at 2.4GHz and 5GHz for enhanced range in wirelessly difficult areas, and Bluetooth 4.2 with BLE support.
• The top side is painted with metal shielding rather than plastic as in previous generations, which works as a heat sink and drains excess heat if the board is subjected to high temperature or pressure.
• This B+ model is three times quicker than the Pi 2 and 3, which is a significant advancement in terms of speed, capable of performing various functions at a reasonable rate.
• The ethernet interface has a speed of 300 Mbit/s, which is substantially faster than the previous version's speed of 100 Mbit/s. It is known as gigabit ethernet, and it is based on the USB 2.0 interface.

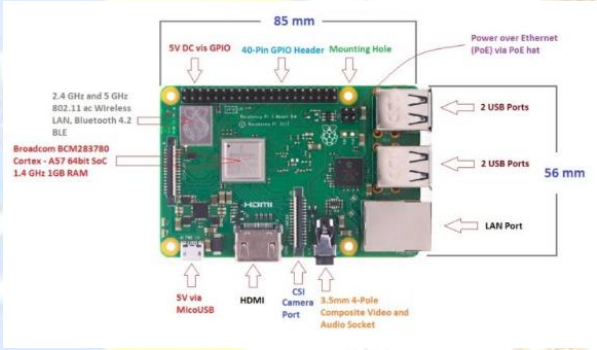


Figure 3 Raspberry PI 3 B+

B. IOT

The Internet of Things (IoT) is a network of ordinary objects — physical objects that are integrated with electronics, software, sensors, and connectivity that allow data exchange. Essentially, a small networked computer is connected to something, allowing information to be sent between the two. Light bulbs, toasters, refrigerators, flower pots, watches, fans, planes, trains, automobiles, or anything else around you can be combined with a small networked computer to accept input (especially object control) or gather and generate informational output (typically object status or other sensory data).

This means that computers will pervade every aspect of our lives – ubiquitous embedded computing devices that are uniquely recognised and interconnected through the Internet. The Internet of Things is truly taking off thanks to low-cost, networkable microcontroller chips. **C.TEMPERATURE SENSOR**

The LM35 series are precision integrated-circuit temperature devices with output voltages that are linearly proportional to the temperature in degrees Celsius. In comparison to linear temperature sensors calibrated in Kelvin, the LM35 device has the advantage of not requiring the user to subtract a large

constant voltage from the output to obtain convenient Centigrade scaling. The LM35 gadget requires no external calibration or trimming to provide typical accuracies of 14°C at ambient temperature and 34°C across the whole 55°C to 150°C temperature range. The LM35 device's low output impedance, linear output, and perfect intrinsic calibration make connecting to readout or control circuitry a breeze.

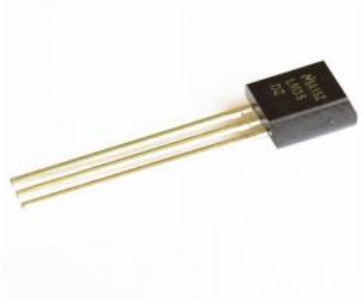


Figure 4 Temperature sensor LM35

FEATURES

- Calibrated Directly in Celsius (Centigrade)
- Linear + 10-mV/°C Scale Factor
- 0.5°C Ensured Accuracy (at 25°C)
- Rated for Full −55°C to 150°C Range
- Suitable for Remote Applications

APPLICATIONS

- Power Supplies
- Battery Management
- HVAC
- Appliances

D.GAS SENSOR

Monitoring of gases produced is critical in today's technological environment. Monitoring of gases is critical in everything from residential appliances like air conditioners to electric chimneys and safety systems in industries. Gas sensors react spontaneously to the gas present, keeping the system informed of any changes in the concentration of molecules in the gaseous state. The gas sensor module is made up of a steel exoskeleton that houses a sensing element.

Through connecting leads, this sensor device is exposed to current. Monitoring of gases produced is critical in today's technological environment. Monitoring of gases is critical in everything from residential appliances like air conditioners to electric chimneys and safety systems in industries. Gas sensors react spontaneously to the gas present, keeping the system informed of any changes in the concentration of molecules in the gaseous state. The gas sensor module is made up of a steel exoskeleton that houses a sensing element. Through connecting leads, this sensor device is exposed to current. from copper and have tin plating over them.

Figure 5 Gas sensor

FEATURES

- Operating voltage: 5VDC
- Operating current: 100-150mA
- Both analog and digital output
- Simple drive circuit

APPLICATIONS

- Hydrogen gas leakage detection
- Portable gas detector
- Fire safety detection system

E. L293D DC MOTOR DRIVER MODULE:

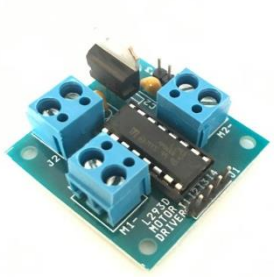


Figure 6 Motor Driver Module

The project is built around the L293D IC. The L293D is a high-current quadruple half-H driver. The 293D is intended to deliver bidirectional drive currents of up to 600mA at voltages ranging from 5V to 36V. The L293D Adapter Board is a dual DC motor driver and a bipolar stepper motor driver. Bidirectional DC motor controller and stepper motor driver, useful in robotics applications. To reduce dissipation, use a separate logic supply. L293D has output clamping diodes for protection.

SPECIFICATIONS

- Motor/Logic supply 5 to 36 V
- Logic controls input 7 VDC max
- Inhibit facility/enable
- High Noise immunity
- Over temperature protection

F. DC MOTOR:

As indicated the relationship between torque vs. speed and current is linear; as the load on a motor grows, speed decreases. The graph depicted below depicts the properties of a standard motor. Long life and good performance can be expected if the motor is utilised in the high efficiency zone (shown by the shaded area). Using the motor outside of this range, on the other hand, will result in severe temperature rises and damage of motor parts. The fundamental rating point of a motor is slightly lower than its maximum efficiency point. Load torque can be calculated by measuring the current drawn while the motor is connected to a machine with a known actual load value..

Figure 7 DC MOTOR

FEATURES

- Supply voltage: 12VDC
- Speed: 60rpm
- Long Lifetime, Low Noise, Smooth Motion
- Equipped with high efficiency

APPLICATIONS

- Coin Changing equipment
- Peristaltic Pumps
- Damper Actuators
- Fan Oscillators
- Photo copier
- Ticket printer

G. PIR SENSOR

A PIR sensor is also known as a motion sensor or a motion detector. With the use of Arduino and PIR sensors, we can actually make motion sensors or motion sensing lights that are available on the market. As a result, this tutorial serves as an introduction to building a motion sensor or a motion detector using Arduino. PIR is an acronym for PYROELECTRIC ("Passive") INFRARED SENSOR. It is based on infrared technology, has an automatic control module, high sensitivity, high reliability, and operates at ultra-low voltage, and is extensively used in various auto-sensing electrical equipment, particularly battery-powered automatic controlled products.

Figure 8 PIR Sensor

FEATURES

- Sensing range: less than 120 degree, within 7 meters.
- Temperature: – 15 ~ +70
- Lock time: 0.2 sec
- Voltage: 5V
- Power Consumption: 65mA

APPLICATIONS

- Automatically sensing light for floor, bathroom, basement, porch, warehouse, garage, etc,
- Ventilator, alarm, etc.
-

H.ZIGBEE WSN

Zigbee is an IEEE 802.15.4-based specification for a set of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power, low-bandwidth needs. It is intended for small-scale projects that require wireless connectivity. As a result, Zigbee is a wireless ad hoc network with low power, low data rate, and near proximity (i.e., personal area).

Transmission distances are limited to 10-100 metres line-of-sight due to low power usage and environmental variables.[1] Zigbee devices employ a mesh network of intermediary devices to relay data over large distances in order to reach farther-off devices. Zigbee is typically employed in low-data-rate applications that require long battery life and secure networking.

Figure 9 zigbee 2.4 ghz

FLOWCHART:

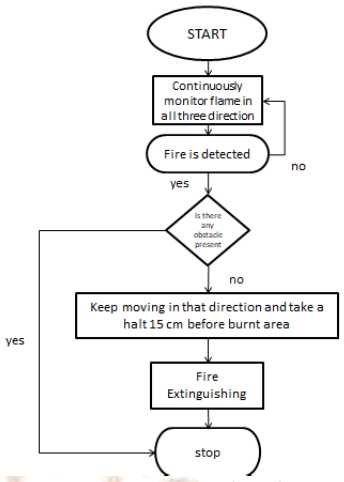
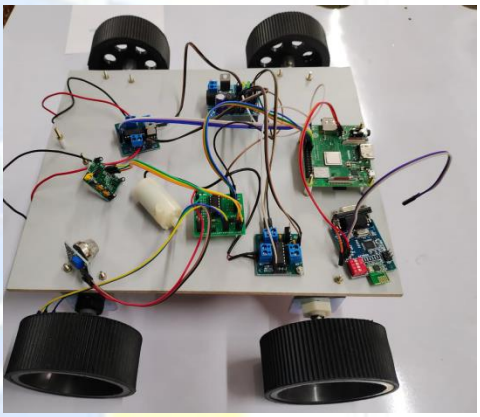


Figure 10 Flowchart

As the above figure 10, the flow design represent the procedure for robot overall working. It states that the robot start monitoring about flames continuously in all the three direction .If the fire is detected then it will look up for any obstacle present in that area, if any obstacle is present then it will send message and take halt 15 cm before the burnt area and use water as fire extinguisher to control the fire in that area and immediately send emergency message to forest department and nearby fire station. In case fire is not detected then it will monitor the flame continuously.

PROJECT OUTPUT:



CONCLUSION

The detection of fires is a severe problem. To avoid fire disasters, it is vital to invest in various fire detection techniques that help predict flames in advance, avoiding their spread over a vast region.

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