IOT BASED GAS AND OIL LEAKAGE PROTECTION IN INDUSTRY USING ROBOTICS

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Abstract— with the advent of technology, humans are replaced with robots in life-threatening situations. Our project "Fire Fighting Robot" is robots that autonomously detects and extinguish fire. It use thermal sensor for detection ,It detects until 10m range, and Arduino UNO R3 for processing, Here the robot will automatically detects the fire by means of temperature sensor and by manual Bluetooth method and ultrasonic sensor it moves near to the flame ,after the detection of fire by automatic method, The robot vehicle is loaded with water tank which contain up to 2Ltr of water and pump motor which is controlled through motor driver circuit to spray water, It which flows by connecting stepper motor with the shaft which connects with gear will comes out automatically to splashing water to extinguish fire, After extinguishes the shaft returns to its original position and then temperature sensor checks the temperature of fire until room temperature constrain.

Keywords*— CO2 sensor, Robot, GSM, Ultra sonic sensor*

I.INTRODUCTION

Using Four-wheeled differential drive robot, flame sensors, ultrasonic sensors and Arduino IDE, an autonomous was designed to detect fires, extinguish and avoid obstacles. The scope of the project in the industrial sector is vast, especially in the fire department. The main operation of the robot is to detect and extinguish the fire source with the input from the flame sensors and extinguishing flames with CO_2. It has a field of view of 180º to detect flames with obstacle avoidance to maneuver in the surroundings. This is achieved by integrating three flame sensors capable of detecting flames into the robot 60° apart in order to achieve an 180° field of view. Since each flame sensor has a field of view of 60°. By using three sensors, a general direction of flame can be computed by the data read from each sensor.

In order to extinguish the flame, a 16g CO_2 cartridge mounted on the robot is discharged. A CO_2 Bike tire inflator is modified as a fire extinguisher by attaching a servo motor to the lever to discharge the cartridge. The firefighting robot is built upon an obstacle avoidance robot. A ultrasonic sensor is used in order to design an obstacle avoidance robot. The distance between the objects ahead of the distance sensor and the robot can be computed by reading the digital values from the ping ultrasonic sensor from an Arduino UNO. The ultrasonic sensor is mounted on a servo motor to pan the surrounding in order to choose an optimum path when it encounters an obstacle.

II.LITERATURE REVIEW

Robotics motion control can be divided into two categories sensor based system and vision based system. The Sensor-based system will be controlled by the feedback from the different sensors such as obstacle sensor, IR sensors, flame sensor etc., while vision based system uses the cameras and the image processing techniques to find the target position.

Firefighting robot is designed to be an unnamed ground vehicle, implemented for finding and fighting the fire. Few types of robot's vehicles are fighting the home fire and fighting forest fires [1]. The fire event may involve more dangerous in life. One of the most important systems in the fire detection function system is an intelligent home [2]. The system can have designed an intelligent multisensor based security that contains a firefighting robot in our daily life [5]. Security and Firefighting advanced robot which is used in the UK is very low in cost and have high performance of detecting fire and extinguishing them [4]. For the novel fire around the surroundings using image processing and device controlling algorithms to detecting fire fastly and accurately [7].

In present days' problem of safety on road and railways tunnels considered to more risk connected to fires, this robotic system can be installed on the existing tunnels without requiring significant modifications of the existing infrastructures [8]. The designing of an autonomous mobile robot that navigates through a maze searching for a fire in a room (burning candle), it detects the candle's flame through sensors, and then extinguishes the flame, and returns to a starting location of the maze. This fire-fighting design interdisciplinary design in colleges [9]. Using Fire extinguisher with gas such as CO2 and N2 has advantages compared ones with water. For example, they provide electrical insulation, they avoid water damages to constructions, electrical equipment's, paper materials, etc., it may useful in spaces hidden from extinguishers [10].

In this robotic system, obstacle avoidance and detection using ultrasonic sensors in large fire fields under large smoke at higher temperature situations, the transducer, anti-jamming processing is designed [11]. In [12], authors proposed a PID controller based on back-propagation (BP) neural networks which are used only in PID controller. To reduce the error rate parameters of PID controller are adjusted concurrently in real time. In [6], an intellectual PID control, which determines system dynamics and states using error and error rate information as an input of the controller, of the robotic system. The 'size and weight' and 'cost and performance' of firefighting robots are problems in present conditions [3]. In this paper, we are designing a firefighting robot with obstacle avoidance and detecting the fire flame and extinguishing the flame.

III. HARDWARE IMPLEMENTATION

In order to obtain the desired mobility and speed, a four-wheeled differential drive robot is used for this application. Dual MC33926 motor controller motor board is used to control the four 12V DC motor on the robot. Arduino UNO is used to read the Analog and digital values from the sensors and also to send control signals to the motor controller board. The Arduino UNO generates a PWM signal to control a servo motor attached to the bike tire inflator in order to discharge a CO2. This can be achieved by mounting a suitable servo motor's arm to control the inflator. A mount is 3D printed as shown in Fig A.

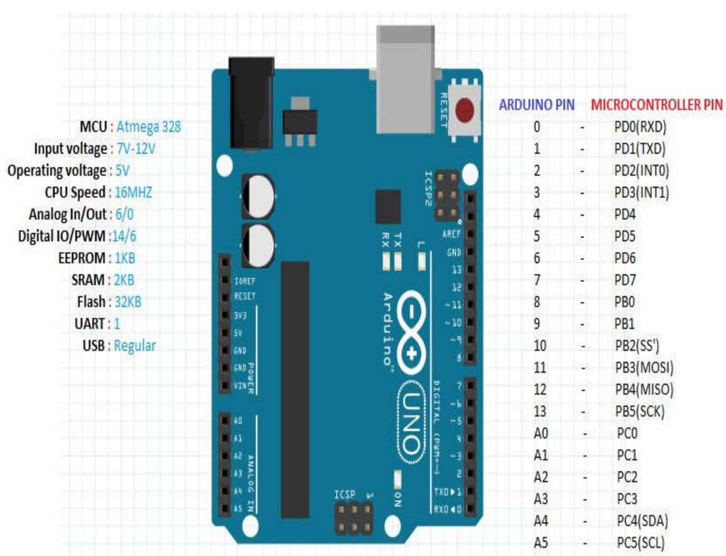

Figure 3.1. Arduino controller

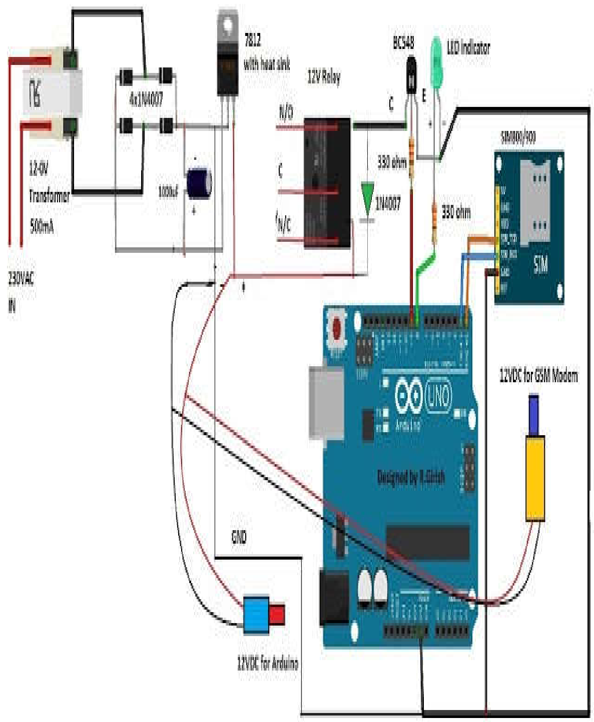

Figure 3.2 Overall Circuit Diagram

The 3D printed part will mount the Bike tire inflator and the high torque servo motor. This unit can then be mounted on an existing differential drive robot. By turning the servo motor, the CO2 can be discharged from the cartridge. It is to be noted that a high torque servo motor such as HS-5685 should be used to discharge the C02 between 3.3 and 5 Volts. Its detection range varies from 20 to 100 cm. And this distance increases with increase in flame intensity. The output from the ultrasonic sensor is used to determine the distance between the robot and the obstacle by interfacing it with the Arduino UNO. This also provides us with sufficient data to not only avoid obstacles but also to maintain a safe distance between the fire source and then extinguish the fire.

IV. SOFTWARE IMPLEMENTATION

The Arduino UNO is programmed using the Arduino IDE. Once the robot is powered ON, the Arduino will initialize a digital I/O pin as an output in order to send control signals to the Ping ultrasonic distance sensor. The ultrasonic sensor returns a pulse whose duration is equal to the time taken for the ultrasonic pulse to travel from the sensor to the object and back. This pulse is sent back to the I/O pin of the sensor. Hence the Arduino digital I/O pin should be made as input in order to read this pulse. The 'pulseIn()' function of the Arduino library provides us the pulse duration on the digital pin. We know that the pulse duration received is for the wave to propagate from the sensor to the object and back again. Hence, we divide the pulse duration by 2. In order to calculate the distance, we use the speed of sound and the pulse duration.

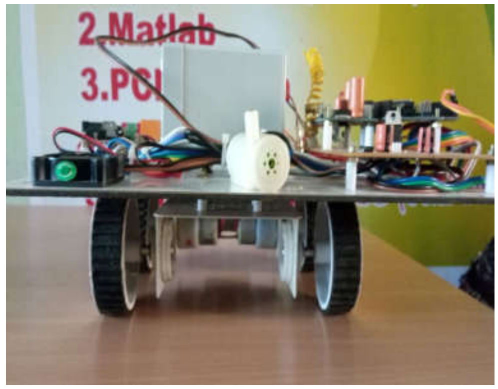

Figure 4.1. Prototype of the propo

The flame sensor outputs a digital and an Analog signal. For higher accuracy, we use the ADC on the Arduino to read Analog signals instead of the digital values. The flame detector sensor has a detection angle of 60°, hence three sensors are used to obtain a detection angle of 180°. The flame sensor operates Once the distance is computed, we compare it to a pre-set threshold value. The pre-set threshold value is a safe distance the robot maintains from an object.

This value can be obtained from practical testing. If the measured distance is more than the threshold, the robot continues to move forward. If the measured distance is less, the servo motor to which the Ping ultrasonic sensor is mounted is controlled by sending PWM signals using the 'servo.h' library functions. The sensor is moved left to right to measure the least obstacle path. Once that is determined, the robot makes a turn in that direction and continues to move forward. There are three flame sensors mounted on the robot. The analog values from these sensors are read continuously to detect any fire source. Once the flame sensor is detected, by comparing the output analog values of each sensor, the direction of flame can be established. Once the direction is established, the robot is made to turn in small increments for the middle sensor to aim at the fire source. Then the CO2 cartridge is discharged and the robot makes a turn and continues to maneuver around the building.

V. SIMULATION

The flame sensor is sensitive to the wavelength of 760nm to 1100nm. Hence any source of light in that bandwidth can be used for testing. Considering safety, a regular lighter or a candle can be used to mimic as a source of the fire. A candle of suitable dimension can be kept lit in a room, the robot functioning as an obstacle avoidance robot will detect the flame while maneuvering across the room. Once the flame is detected, the robot positions itself facing the flame source and stopping at a safe distance and extinguishes the fire. It then automatically makes a turn in order to avoid going over the flame source.

VI. RESULTS

The Fire-Fighting robot is capable of detecting flames and extinguishing them successfully. The motor controller and Arduino code work together to control the movement of the robot with obstacle avoidance. It can detect the flame more effectively in the buildings and fixed lighting conditions. The robot is designed for the indoor application. Since the ambient daylight varies throughout the day, a dynamic threshold value is necessary to compensate for the change in ambient light. Use of high torque servo motor was necessary to discharge the CO2 Cartridge.

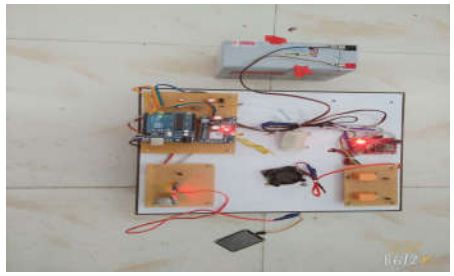

Figure 6.1 Hardware View

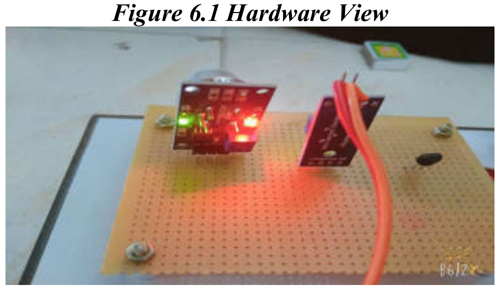

Figure 6.2 Smoke Sensing view

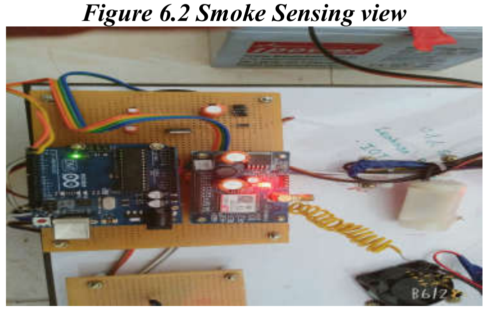

Figure 6.3 GSM Activation

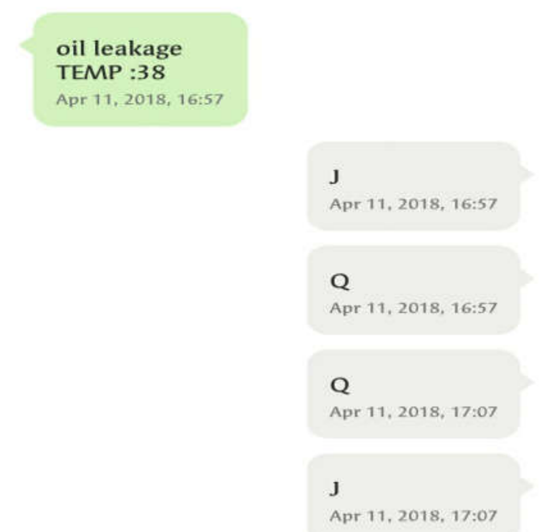

Figure 6.4 fault information receiving image

VII. Conclusion

The design was successfully implemented on a four-wheel drive robot. The 3D printed mount was mounted on the front of the robot's chassis. The battery is mounted inside the robot to prevent any damage to the battery from external fire source. The ultrasonic sensor was directly mounted on a servo motor. The robot successfully detected multiple flame sources and extinguished them from a safe distance. The speed of the robot was reduced to the desired speed in order to increase the operating time and efficient detection of the flame source. The flame sensor threshold values need to be manually obtained.

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