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A Review on Wireless IOT Based Industrial Security Robot

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Abstract - *We observe that in any industry a large amount of work is repetitive and hence boring or tiresome. One of such work is the security check or general audit related to gas leakage or fire appliances. In past many years industrial accidents has rose as a bigger challenge in India. It was reported that there were nearly about 6300 deaths in 8004 incidents of industrial accidents while there were 30 industrial accidents in a single month from May to June 2020. So, looking at the seriousness of the issue it will be wise and sensible to automate this process using robots. The main objective of the project is to build a cost efficient wireless robotic system for industrial security application with wireless video streaming in the area which is hard to reach or hazardous areas thus by substituting the human in such areas.*

Key Words: **IoT, MQ2 Gas Sensor, Fire Sensor, Android Application, NODEMCU ESP8266, ESP32-Cam, L298N Motor Driver**

1.INTRODUCTION

A robot is designed and constructed here to move into different locations and receive the details of that area with the help of inbuilt sensors on it. The sensors on it can detect gas like CO, LPG, smoke. The robot also detects the fire. The robot acts according to the command given by the program. It will move in all the direction like forward, reverse, right and left. The Robot will send the real time streaming, which could be seen at monitor or mobile through wireless connection of Wi-Fi module i. e one can control the robot with the help of mobile or laptop through Internet of Things (IoT).

1.1 LITERATURE SURVEY

Since the development of first robot by George Devol in 1954, robotics has been evolved so far rapidly in many fields. There are vast applications of robots in industrial and military work hence reducing manpower with the help of IOT and AI. In recent years robotics is also applied in security purpose or as surveillance robot in industries and military applications.
According to the P. Parameswari et.al., 2014 [1], Zigbee transmitter and receiver was used to create a wireless robot. AT89S52 was the key microcontroller to control all the other sensors. LCD display was used to show the output.

According to Jayant Patil, 2017 [2], Raspberry Pi was used to control the sensors, motor driver, LCD display and an external camera, while external wife module was used to create a Wi-Fi network.

According to M. Ashok Kumar et.al., 2018 [3], Arduino UNO was used as the core microcontroller to control the devices while Nodemcu ESP8266 was connected to send the data of the sensors to cloud database.

According to G. Anadravisekar et.al., 2018 [4], Arduino UNO was the controller used to control Wi-Fi module, sensors, camera and dc motor. External power supply was generated of 12 volts by connecting two 6-volt batteries.

The evolution of the project was observed from microcontrollers to Arduino IDE and from Bluetooth module to ZigBee module further extending to Wi-Fi module. We found that the Wi-Fi module would provide added security and added range of distance. The Nodemcu Esp8266 was found to be useful to be used as a Wi-Fi module and also the sensors can be integrated on it. While ESP32 cam which has integrated camera can be used for surveillance as well as for controlling the motor driver to control the directions.

2. PROPOSED WORK-

The ultimate goal of this project is to design and construct a robot to move into different locations and receive the details of that area with the help of inbuilt sensors on it. We are well aware that every hardware system has a main component (also called as a brain of the system) which is used to control the system by giving a set of instructions. So as shown in Fig -2.1, we have two main components in our system which are Nodemcu Esp8266 microcontroller and Esp32-Cam. Here, the Esp32-Cam is used for surveillance purpose as well as for controlling the L298N Motor Driver module. The L298N Motor driver is used to control DC motor for both speed and rotating directions. The PWM technique is used to vary input voltage in order to control the speed of the motor while the H-Bridge circuit is used for controlling the rotation direction of the motor.

NODEMCU Esp8266 microcontroller is used to control the sensors like MQ2 Gas Sensor and Flame Sensor mounted on the robot. MQ2 Gas Sensor is used to detect the presence of gases like LPG, CO and Smoke. The values of the presence of particular gas are found in ppm in the most accurate way

possible. The flame sensor is used to detect and respond to the occurrence of a fire or flame.

So, summing up the hardware part of the system we can state that a system is designed in which Esp8266 module is used to control the industrial security related sensors while the Esp32 cam is used for surveillance as well as for controlling the direction of the robot.

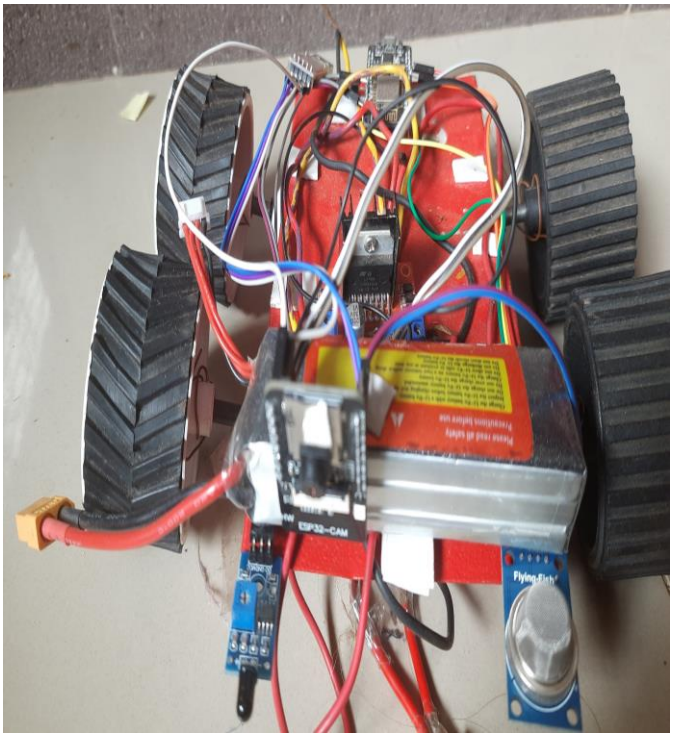

Fig -2.1: Hardware setup of the project

The two different web applications are designed using HTML for two different controller's output. The application of ESP 8266 as shown in Fig -2.2 has the values of LPG, CO, Smoke which are taken from by processing the analog data of MQ2 Sensor while the message for presence of fire or flame is given by reading the digital data of flame sensor. The MQ2 Sensor analog output is processed using C programming in Arduino ide in which some complex mathematical equations are performed on the logarithmic graph data of the Rs/Ro v/s Gas in ppm graph. The slope of each gas is used for the purpose of calculating the accurate value in ppm of the gas.

The application designed for ESP32 Cam as shown in Fig -2.3 consist of the surveillance video frame in it. Also, the controls of the motor like forward, backward, left and right are present on the web application.

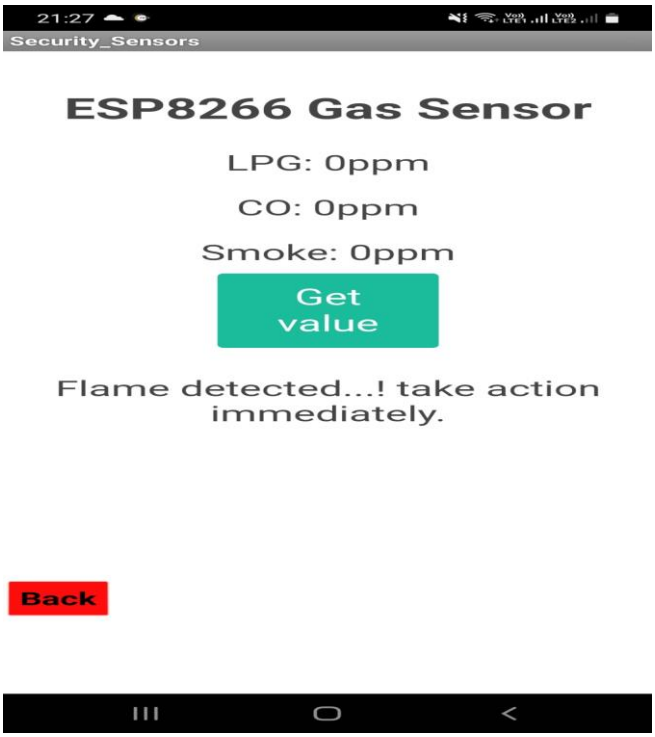

Fig -2.2: Security Sensor Web App

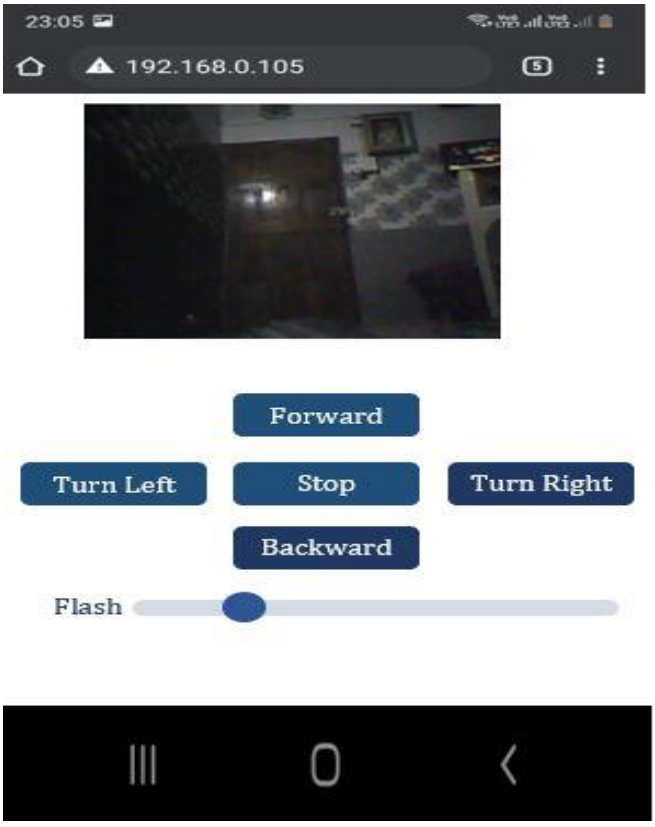

Fig -2.3: Video streaming and motor control web app

2.1 BLOCK DIAGRAM-

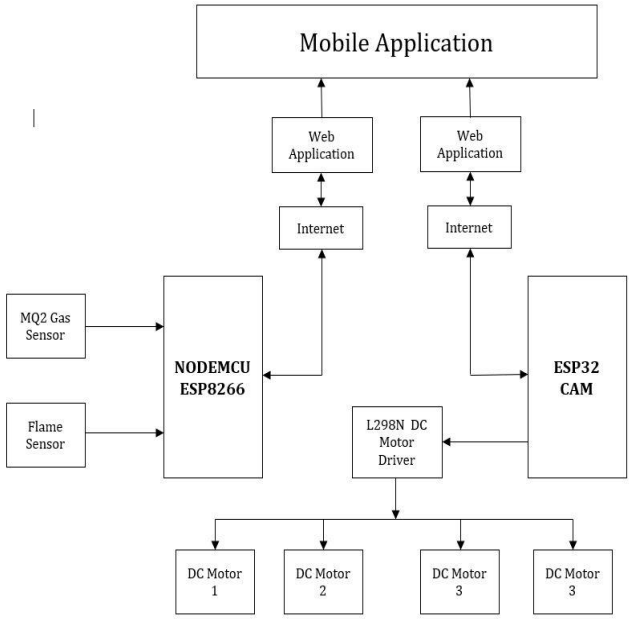

Fig -2.1.1: Block Diagram of System

The block diagram in Fig -2.1.1 is the short diagrammatic representation of the proposed work of the system. It clearly shows which components are controlled by which controller and also explains how the software application is used to control the hardware and also display the output.

2.2 HARDWARE COMPONENTS USED –

1)NODEMCU ESP8266 - ESP8266 is well suited for the project as it has inbuilt Wi-Fi trans-receiver on 12E module version with 128kb ram and 4Mb Flash Memory. It can connect to a local Wi-Fi network and if it is not available then it can also set up its own Wi-Fi network.

2)ESP32 Cam – ESP32 Cam can be used for surveillance as it supports OV2640 and OV7670 cameras with built-in flash. It also supports uploading over Wi-Fi.

3)MQ2 Gas Sensor – It is used to detect the presence of LPG, CO, Smoke, etc. It has analog pin which gives the decreasing change in the value of onboard resistance with the increasing concentration of gas. It should be powered up with 5v power supply.

4)Fire Sensor – It is used to detect the presence of fire or flame in which sensing is conditioned by LM393 comparator. The working voltage of flame sensor is between 3.3v and 5v.

5)L298N Motor Driver – It is a motor driver module used for driving DC and Stepper Motors. It can be used to control 4 dc motors or 2 motors with speed and direction control. It should be powered up with 12-volt power supply.

6)Lipo Battery: - A lipo battery of 11.1 v /2200mAh can be used to power up the motor drivers for robots and drones.

3. ADVANTAGES-

1)The bot can be used to inspect areas which are difficult/risky for humans.
2)This avoids costly precautions which are used to safeguard humans.
3)Bot is portable hence it has advantage over cctv or any other static surveillance systems.
4)A bot with cheap price can be designed where discontinued surveillance is required.

4. CONCLUSIONS

Robotic supervision is a good replacement for the cctv surveillance or any other static surveillance systems which are present in the industry. So, our designed system is the better option for it. It ultimately increases efficiency of work, improves the accuracy and is also movable. The robot can be adjusted to any industrial plant after making some changes according to the requirement of the industry. The situations can also be recorded which can save the time and work of manual supervision.

5. ACKNOWLEDGEMENT

It gives us great pleasure in bringing out the project entitled Wireless IOT Based Industrial Security Robot. The project is something that could not have been implemented without cooperation of many people. We take this opportunity to sincerely thank Prof. Pooja S. Tanurkar, without her help and guidance this project would not be in the current condition. The keen interest of our guide helped us to solve difficulties. We are also thankful to our respected head of department of Electronics and Telecommunication Engineering of Government College of Engineering, Karad Dr. A.M. Sakpal sir who gave us the opportunity to work on the project and helped us by providing valuable suggestions.

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