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Intelligent Security Robot

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***Abstract*—** This project proposed is an embedded system for security purpose robot using RF module communication. The robot has sensors for detecting Gas leakage and high temperature. MQ6 Gas sensor detects the presence of bio hazardous gases like LPG, iso-butane, propane, LNG and alcohol, and the PIR sensor detects only the living organism (Intruder). The sensor details are first sent to the microcontroller which resides at the robotic side and then sent to the local system through RF module. The system also provides an audio and visual alarm to alert about the critical situation for the safety and security purpose. This robot also has a battery powered wireless AV camera which provides robotic in front environment information to the Local and remote system. The robotic movement is controlled remotely from the local system by using the front end application VB Form application. This proposed system is used wherever people cannot go or where things doing too dangerous for humans to do safely. That is the robot can move and reach to the high destiny gas leakage region. The robot will be placed on tracks on the top of the room, thereby causing no inconvenience to the people moving in the room. The robot will move across all the walls of the room providing complete audio and visuals of the environment as well as if any gas or high temperature and an intruder is detected when the room is closed.

***Keywords*—** Robot; live audio and video streaming; gas sensor; PIR sensor; temperature sensor; arduino board; RF module.

I. INTRODUCTION

The robot's design specifications may vary according to the given application. An embedded system is designed to perform specific control functions within a larger system, often with temporal constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems contain processing cores such as microcontrollers, microprocessors. The key characteristic, however, is being dedicated to handle particular task, design engineers can optimize it to reduce the size and cost of the product and increase their reliability and performance. The concept of wireless communication plays an important role in this system. The robot is given artificial intelligence i.e. it senses the environment around it and alerts the user in case of any disorder.

II. PROPOSED SYSTEM

The robot is designed and constructed with associated electronic circuits to move into any unknown location and transport the details of that unknown area to a home place. Here, the robot will be used in industries where it can detect gas leakage, high temperatures, an intruder entering the area. It will move on tracks placed across the wall similar to a metro, thereby providing complete visuals of the room and sensing the entire room. The robot can also be controlled by the administrator in the control room with the help of a GUI interface that will display the visuals as well as if any disorder takes place. The communication between the robot and the control room will be wireless with the help of RF module. This project consists of the following circuits:

- Arduino boards
- Gas sensor
- PIR sensor
- Temperature sensor
- RF module
- AV wireless camera
- DC motors

III. HARDWARE AND SOFTWARE DESCRIPTION

1. *Arduino Board*

Arduino is common term for a software company, project and user community that designs and manufactures computer open-source hardware, open-source software and microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices. In this project, we use the Arduino board on the robot that will handle the sensors and the RF Receiver and another Arduino board at the local system for handling the RF transmitter. The Arduino boards will be programmed using the Arduino software with the help of USB cables. An Arduino Nano board will be used at local system end and an Arduino Duemilanov board will be used on the robot.


Fig 1.a. At local system.

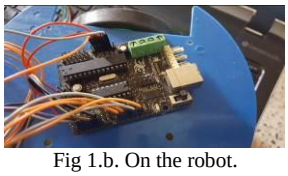
Fig 1.b. On the robot.

2. *Gas Sensor*

This is a simple-to-use liquefied petroleum gas (LPG) sensor, suitable for sensing LPG (composed of propane and butane) concentrations in the air. The MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm. This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance. The drive circuit is very simple; all you need to do is power the heater coil with 5V, add a load resistance, and connect the output to an ADC. The MQ-6 Gas

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sensor is connected to the analog pin 0 of the arduino board on the robot.

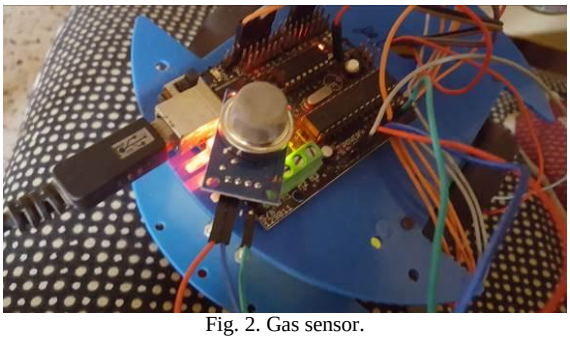

Fig. 2. Gas sensor.

3. *PIR Sensor*

A Passive Infra-Red sensor (PIR) is a device used to detect motion by receiving infrared radiation. A PIR detector Combined with a Fresnel lens (FL65) is mounted on a compact size PCB together with an analog ICSB0081 and limited components to form the module. A Fresnel lens is a Plano Convex lens that has been collapsed on it to form a flat lens that retains its optical characteristics but is much smaller in thickness and therefore has less absorption losses. The FL65 Fresnel lens is made of an infrared transmitting material that has an IR transmission range of 8 to 14 µm that is most sensitive to human body radiation. The PIR detects the intruder only if he is in the lens coverage range of 140o, which means 5 to 7 meters from the centre of lens. The PIR sensor is connected to the digital pin 7 of the arduino board on the robot.

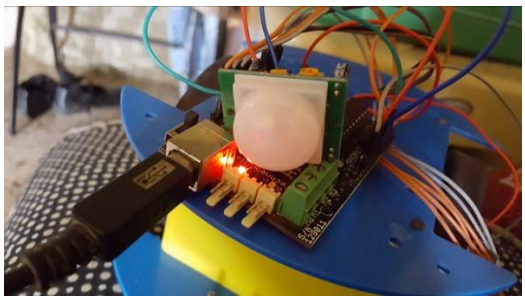

Fig .3. PIR sensor.

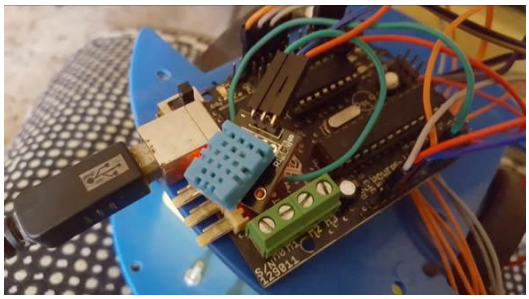

Fig. 4. Temperature sensor.

4. *Temperature Sensor*

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. It is connected to digital pin 8 of the arduino on the robot.

5. *RF Module (nRF24L01)*

The nRF24L01 is a highly integrated, ultra-low power (ULP) 2Mbps RF transceiver IC for the 2.4GHz ISM (Industrial, Scientific and Medical) band. With peak RX/TX currents lower than 14mA, a sub µA power down mode, advanced power management, and a 1.9 to 3.6V supply range, the nRF24L01 provides a true ULP solution enabling months to years of battery lifetime when running on coin cells or AA/AAA batteries. The receiver is placed on the arduino which is placed on the robot and the transmitter on the arduino placed at the local system. The main logic required for successful communication between the robot and local system is that both the circuits should be in listening mode, it will go to transmit mode only when it has something to send. This will help establishing half duplex communication between the robot and the local system. Libraries have to be installed so as to use this module.

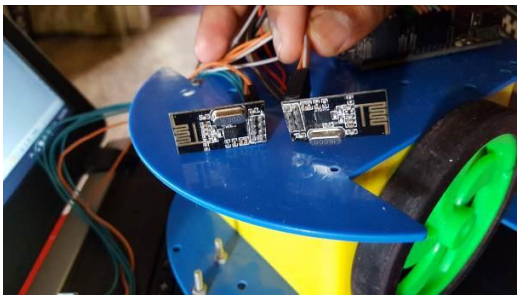

Fig. 5. nrF24L01 module.

6. *DC Motor*

A 12V DC geared motors is very easy to use and available in standard size. Nut and threads on shaft is easily connected and internal threaded shaft are easily connecting it to wheel. The 12V DC Geared Motor is used in variety of robotics applications which is available in wide range of RPM and Torque. Two DC motors are used for the two wheels of the robot. The wires from the motor will be connected to the motor shield and from the motor shield to the arduino board of the robot to digital pins 2,3,4,5 respectively. For moving the robot in forward direction, set the pins 2 and 3 to HIGH and pins 3 and 5 to LOW. For moving the robot in backward direction set pins 3 and 5 to HIGH and pins 2 and 4 to LOW.

Fig. 6.a. DC motors.

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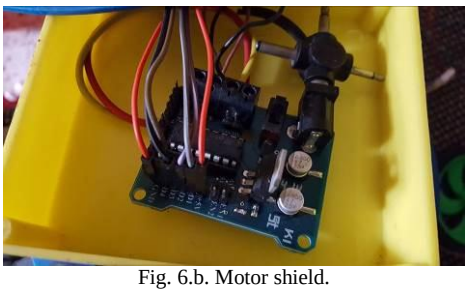

Fig. 6.b. Motor shield.

7. *Wireless av Camera*

The C3038 is a 1/3" color sensor module with digital output. It uses Omni Vision's CMOS image sensor OV6630. Combining CMOS technology together with an easy to use digital interface makes C3038 a low cost solution for higher quality video-image application. The digital video port supplies a continuous 8/16 bit-wide image data stream. All camera functions, such as exposure, gamma, gain, white balance, color matrix, windowing, are programmable through I2C interface. A TV tuner is set up at local system via Easy Cap USB 2.0 which receives signals from the AV camera and displays it on the monitor.

Fig. 7. Wireless AV camera.

8. *Visual Studio Application*

A programming language and environment developed by Microsoft. Based on the BASIC language, Visual Basic was one of the first products to provide a graphical programming environment and a paint metaphor for developing user interfaces. Instead of worrying about syntax details, the Visual Basic programmer can add a substantial amount of code simply by dragging and dropping controls, such as buttons and dialog boxes, and then defining their appearance and behavior. Although not a true object-oriented programming language in the strictest sense, Visual Basic nevertheless has an object-oriented philosophy. It is sometimes called an event-driven language because each object can react to different events such as a mouse click. Since its launch in 1990, the Visual Basic approach has become the norm for programming languages. Now there are visual environments for many programming languages, including C, C++, Pascal, and Java. Visual Basic is sometimes called a Rapid Application Development (RAD) system because it enables programmers to quickly build prototype applications. We have developed a basic form application which has the interface for the wireless AV camera, it can also take a snapshot of the scenario. Buttons for controlling the robot are also added as well as a check button which helps us in manually checking the environment. This is our GUI interface.

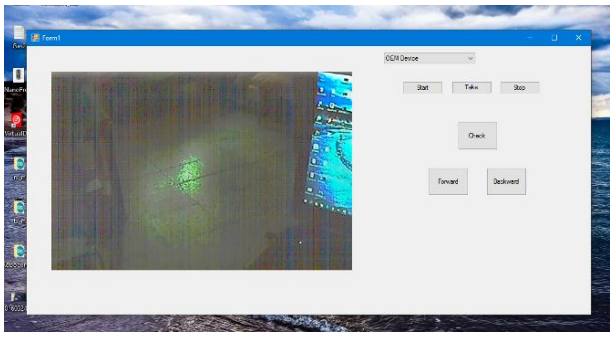

Fig. 8. GUI interface on visual studio.

9. *Arduino Software*

Arduino programs may be written in any programming language with a compiler that produces binary machine code. Atmel provides a development environment for their microcontrollers, AVR Studio and the newer Atmel Studio. The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and provides simple one-click mechanism to compile and load programs to an Arduino board. A program written with the IDE for Arduino is called a "sketch". The Arduino IDE supports the languages C and C++ using special rules to organize code.

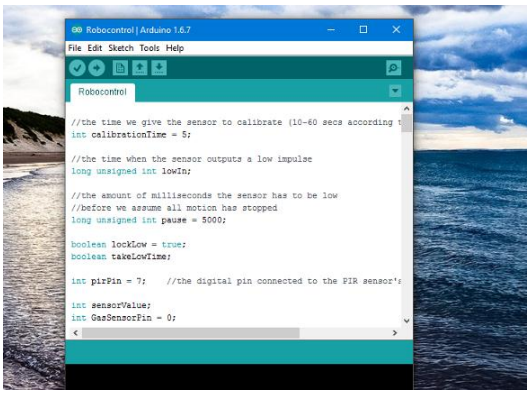

Fig. 9. Arduino IDE.

The Arduino IDE supplies a software library called Wiring from the Wiring project, which provides many common input and output procedures. A typical Arduino C/C++ sketch consist of two functions that are compiled and linked with a program stub main () into an executable cyclic executive program:

- setup(): a function that runs once at the start of a program and that can initialize settings.

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- loop(): a function called repeatedly until the board powers off.

With the help of this software we upload the programs onto the board via the USB cable to the selected COM port and board.

IV. INTEGRATION OF THE SYSTEM

The system integration diagram is shown below:

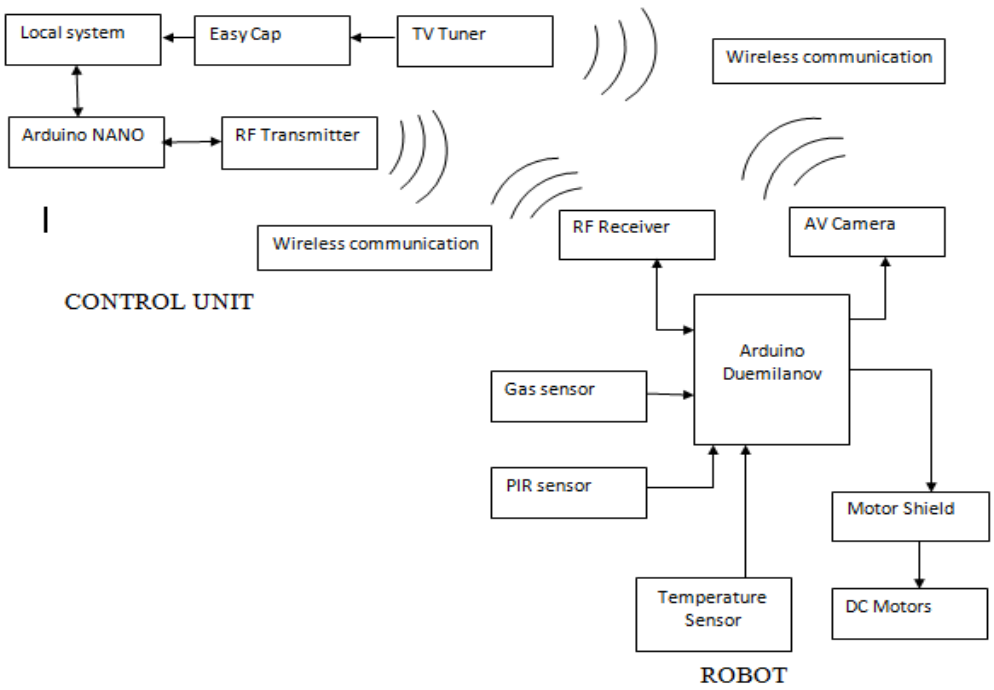

Fig. 10. Integration of the system.

V. CONCLUSION

The proposed robot can be used in war field, mines, power station, military operations, industries, research and educational institutions and so on. And also be used wherever people cannot go or where things doing too dangerous for humans to do safely. The robotic movement is controlled remotely through the local system. The presence of bio hazardous gases like LPG, iso-butane, propane, LNG and alcohol were detected through MQ6 Gas Sensor which is placed at the robot. Similarly the intruder (Human or Animal) entered into the room/ range is detected through the PIR sensor. The above two sensed parameters were sent to the local system through the RF module which is presented at both the ends, that is at the robot and at the local system. And at the same time an audio and visual alarm is raised. A wireless AV camera resides at the robot; send's the robotic environment information to the local system.

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REFERENCES

[1] V. Ramya, B. Palaniappan, and S. Prasad, "Embedded controller for radar based robotic security monitoring and alerting system," *International Journal of Computer Applications (IJCA)*, vol. 47, no. 23, 2012.

[2] V. Ramya, B. Palaniappan, "Embedded system for hazardous gas detection and alerting," *International Journal of Distributed and Parallel Systems (IJDPS)*, vol. 3, no. 3, 2012.

[3] M. Ben Gaid, R. Kocik, Y. Sorel, R. Hamouche, "A methodology for improving software design lifecycle in embedded control systems," *In Proceeding of Design, Automation and Test in Europe (DATE)*, Munich, Germany, 2008.

[4] R. ZHANG, F. He, Z. Du, and L. Sun, "An intelligent home environment inspecting robot," vol.42, pp. 140-169, 2007.

[5] K. Galatsis, W. Wlodarski, Y. X. Li, and K. Kalantar-zadeh, "Vehicle cabin air quality monitor using gas sensors for improved safety," pp. 143-164, 2000.

Ryan Dsouza, Priyanka Bainagari, and Amruta Dicholkar, "Intelligent security robot," *International Journal of Scientific and Technical Advancements*, Volume 2, Issue 1, pp. 221-224, 2016.