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Multipurpose Security Robot Using Arduino Microcontroller

[1] Dr. S. Inderjeet Singh, [2] Sharmila Mudigonda, [3] Sravanthi Mukkavalli, [4] Nagalakshmi Kotrika

[1] [2] [3] [4] Department of Electronics and Communication, Sridevi Women's Engineering College Vattinagulapally, Gandipet, Hyderabad, India.

Corresponding Author Email: [1] drindar2020@gmail.com, [2] sharmilamudigonda21@gmail.com, [3] sravs2001@gmail.com, [4] kotrika.nagalakshmi@gmail.com

***Abstract*— One of the concerned areas today for the usage of robots is military. It is known that a lot of military organizations are taking the help of robots to perform highly dangerous jobs. They consist of many kinds of sensors and have many other internal applications based on the usage. Some of the most advanced robots are now equipped with cameras that provide live footage, grippers and integrated systems. There are various shapes of the robot based on the application of the robots. To sense the surroundings in a better way, while protecting the lives of humans, this robot would be found useful in defense applications.**

***Keywords*—ultrasonic sensor, metal, gas, pulse sensor, night vision camera, Arduino uno, robot.**

I. INTRODUCTION

The field of robotics include various branches of engineering including electronics, mechanical, digital logic, artificial intelligence, nanotech and bioengineering. The applications of robot are various depending on the type of robot that is built. Robots are designed to do tasks that will reduce the monotonous and boring work for humans, and also assist in the dangerous situations. A robot maybe designed to do a certain task with full capacity or a range of tasks with less capacity.

This paper depicts the study of military spying robots. Bomb or metal detector is used to detect the metal and alerts through LED to notify the presence of any bomb and camera detects the exact location. This paper gives a unique idea of the usage of Raspberry pi and ultrasonic sensor in the robot for military surveillance. The robot gives a live streaming video according to the given commands. This has a Bluetooth receiver for wireless communication. The hardware can be used for both GUI and Android device to control the movements of a robot. Using night vision camera with IP address can reduce the usage of a greater number of cameras. This paper depicts the wireless technology and Bomb Disposal technologies. Robot [1] displays the current operations. This gives a peculiar idea of the usage of gun for firing. Buzzer is used to grab or indicate the attention regarding an emergency situation. This paper gives an idea of controlling the motion of robot based on hand robot interaction. Gesture signal processing is clearly explained. This robot is an obstacle detector. Ultrasonic sensor and robot arm are the unique hardware equipment seen in this robot. It is not sensitive to the environmental changes and weather conditions.

II. DESIGN AND EXPERIMENTAL SECTION

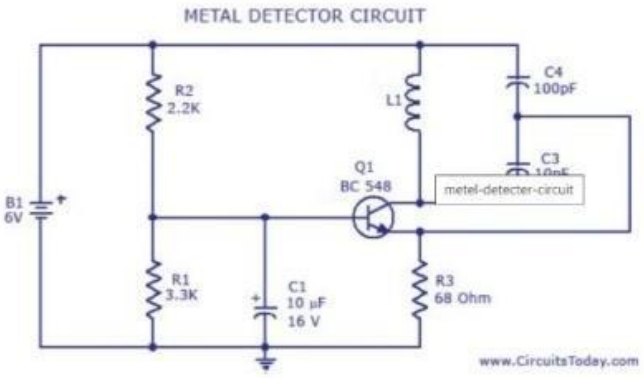
A. Sensing unit

in order to make the robot sense its surroundings, it has to be equipped with various [2] kinds of sensors. It works almost like a human body sensing its surroundings.

The sensors that are used here are the ultrasonic sensor, pulse detector, metal sensor and the gas sensor.

METAL SENSOR

A Metal Sensor is an electronic instrument which detects the presence of metal nearby. Metal detectors are useful for finding metal inclusions hidden within objects, or metal objects buried underground. They often consist of a handheld unit with a sensor probe which can be swept over the ground or other objects.



ULTRASONIC SENSOR

An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a[5] transducer to send and receive ultrasonic pulses that relay back information about an object's proximity.

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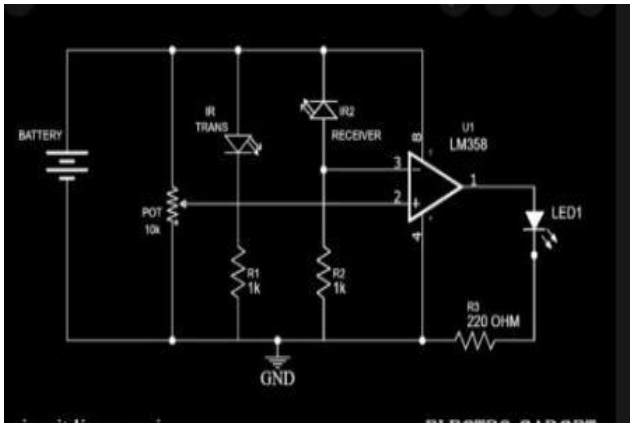
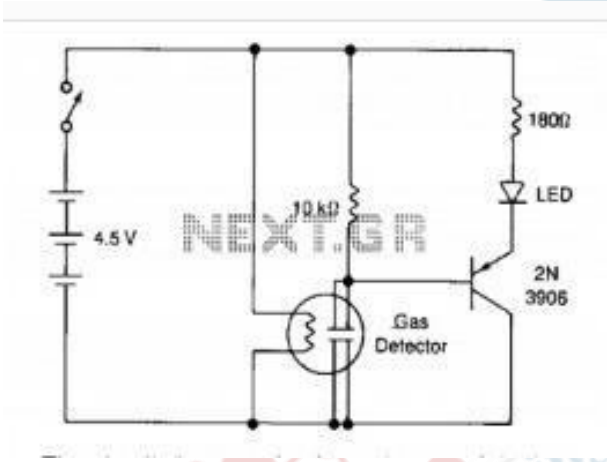


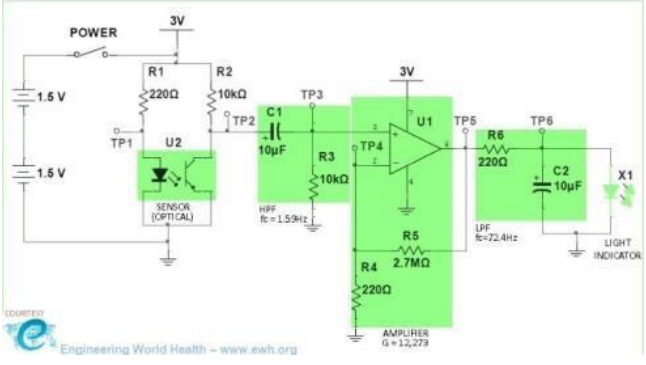
GAS SENSOR

Gas sensors (also known as gas detectors) are electronic devices that detect and identify different types of gasses. They are commonly used to detect toxic or explosive gasses and measure gas concentration. Gas sensors are employed in factories and [3]manufacturing facilities to identify gas leaks, and to detect smoke and carbon monoxide in homes. Gas sensors vary widely in size (portable and fixed), range, and sensing ability.

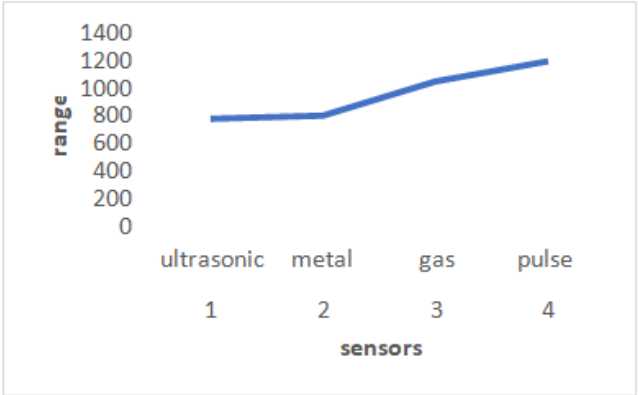


PULSE SENSOR

An alternate name of this sensor is heartbeat sensor or heart rate sensor. The working of this sensor can be done by connecting it from the fingertip or human ear to Arduino board. So that heart rate can be easily calculated.



S. No.	Sensor name	Range Given	Real-time Range
1	Ultrasonic sensor	700-1000	1 meter
2	Metal Sensor	700-1000	1 meter
3	Gas Sensor	700-1000	1 meter
4	Pulse Detector	700-1000	1 meter



B. Communication Unit

The transceiver used in this work is a wireless module board using high-performance Nordic radio chip. It works on the 433MHz band, so, no need to apply frequency usage license. Its actual transmission distance is 10-20 meters depending on the [4] specific situation of the environment and communication band rate settings. SIM900A GSM Module is the smallest and cheapest module for GPRS/GSM communication. It is common with Arduino and microcontroller in most of embedded application. The module offers GPRS/GSM technology for communication with the uses of a mobile sim. It uses a 900 and 1800MHz frequency band and allows users to receive/send mobile calls and SMS.

The esp32 camera is a low-cost module that has Wi-Fi and Bluetooth capabilities. It also supports TF cards or micro- SD cards.

III. PROCESSING UNIT

Arduino UNO

The main processor that is used in this robot is a microcontroller. The microcontroller that we use here is the Arduino uno. The Arduino Uno board is the preferred microcontroller because of its [6] ATMega328P. it has 14 digital input and output pins, out of which, 6 can be used as PWM outputs. It also has 6 analog inputs, a resonator, a USB connection, a power jack, ISCP header and reset button. The board is to be connected to a computer with a USB cable and power it with a AC-to-DC adapter or battery. The programs that are required for the software are written in Arduino using C and C++.

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IV. CONTROL AND DISPLAY UNIT

A multipurpose robot needs to show its output and we need to be able to control it, either through Bluetooth or through mobile application. A sim card is equipped on to the robotic module and that is added in the code. This mobile sim is connected to the [7] mobile data and the through the given hotspot the robot is connected to the smartphone. The certain IP address given for the robotic body is then searched on the internet, and the controls for the movement of the robotic body is then displayed across the screen. Along with this, the live footage of the environment in front of the camera is displayed in a small square.

Whenever the sensors detect something, the movement of the robot ceases and the LCD display that was equipped on to the robot displays exactly what sensor went on, and how much of the material is detected along with the precise values.

V. METHODOLOGY

The input block has several different sensors which all act as input devices. The different sensors that are used in this project are the metal sensor, the gas sensor, the ultrasonic sensor for the obstacle detection, the pulse sensor, the night vision camera. All these sensors work as input devices. When each of the sensor detects or senses something, it acts as an input and takes the input into the microcontroller. The microcontroller that we use here is Arduino Uno. All the inputs, either single or multiple inputs at the same time, are controlled by the microcontroller. This input signal is then passed onto the output as the LCD display, which shows the message of an input being detected. The methodology we use here is the method of transmitting and receiving information for the sensors and then making sense out of it. The transmitter sends out a signal and then encodes it as there are other receivers which may receive this particular signal. After receiving this signal, it is decoded by a decoder and then sent to the microcontroller. The applications and working of each component are given in detail. The microcontroller output is given to the LCD, and it displays the message of what kind of input is detected.

VI. RESULTS

All the sensors work on the principle of transmitting the signals and receiving them, and processing them to be outputs on the lcd display. The sensors work in different ways. Each of them has same results, which is showing on the lcd. The

Obstacle sensor uses the echo mechanism to detect an obstacle and sends the signal, the output will be, obstacle detected. The metal detector can detect any kinds of metal and other weapons and other landmines as such, which are hidden in the ground and give the lcd display output, metal Detected. The gas sensor can detect any harmful gases and radiations that are in the given frequency range, the output will be, gas detected. When there is an injured soldier, and we need to check if the person is dead or alive, then the pulse detector does this work, the output will be, pulse detected. Continuous live footage can be gathered from a night vision camera, which also helps us in seeing

What kind of obstacles we have, instead of just knowing that there is an obstacle. These are the final results that can be expected with the multipurpose war field robot.

TABLE I. Result Table

S.No.	RESULTS		
	DETECTOR TYPE	***RANGE***	***VALUE***
1.	Ultrasonic sensor	700-1000	780
2.	Gas sensor	700-1000	1050
3.	Pulse detector	700-1000	1200
4.	Metal sensor	700-1000	800

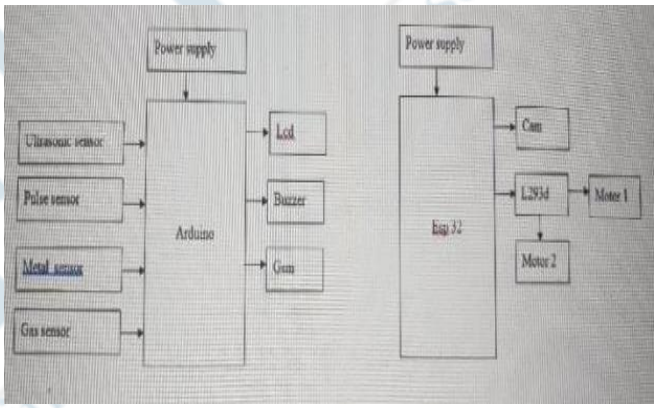

Fig. 1. Tabulation of the results according to different sensors.

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