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IoT-Enabled Bomb Detection and Neutralization: Safeguarding with Smart Technology

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Abstract-Millions of innocent people, along with the soldiers who protect the country, are losing their lives due to the missiles that are kept under the ground. Most people think that the bomb explodes only after stepping off of it, but this is not true. There are numerous fresh technologies emerging, which is why numerous organizations from around the world take part in the demining process. So, we came up with a machine that detects the bomb location in the absence of humans and diffuses it, thereby saving lives. The technique of robotic evaluation of technology is more risky and complicated in order to safeguard an expert's life [9]. The precise and on-time recognition of exploding substances, energetic assets, and their related composites would offer vital information to the armed forces involved in a wide range of conflict actions. This prototype robot can be tracked by a camera as it moves through an area suspected of having explosives. This machine is wirelessly linked to the cloud in order to operate. By doing this, we can save lives, lower expenses, and improve efficiency in the demining process. The GPS used will tell the location of the bomb, and GSM will immediately transfer the data to the nearby stations. The machine is developed so that it is able to diffuse the bomb by itself. The proposed explosive monitoring and dispersal system is demonstrated, and the science behind it creates a potent tool for the military and other relevant industries.

Keywords:
Internet of things (IoT), metal detector, gripper, GPS, GSM, and thingspeak

1.Introduction:

The number of landmine victims who are still living today is around 250 000, many of whom need amputations. At least as frequently as military personnel, civilians, which include a large percentage of women and children, sustain injuries. Landmines are responsible for an additional 10,000-100,000 deaths and injuries each year. [6] Over 100 million active landmines are currently buried or scattered across the globe, and an additional 5,000 are installed each day. The majority of them live in war-ravaged, poor, and underdeveloped nations whose people are already traumatized by conflict. The governments of these nations are unable to afford the process of demining their land, which costs between $300,000 and $400,000 per mine, nor are they able to provide sufficient emergency medical care or rehabilitation for victims of landmines. The presence of mines in agricultural fields, close to water sources, along roads, and around villages prevents people from using these essential resources, which has a significant negative effect on economic growth. Health care professionals are urged to support legislation at the national and international levels that would completely outlaw the production, sale, and use of anti-personnel landmines. As a result, an artificial model is created in order to find an alternative. Simply described, a robot is a computational system that has been trained to carry out certain activities, eliminate manual input, make remarkably accurate predictions, and successfully circumvent human limitations. This robot is used to track the presence of the bomb and disperse it.

2.Literature Survey:

S. Keerthana and AR Vellaiyan [1] suggested applying a wireless camera to locate the metal and assess its potential hazards. If so, use a robotic arm to methodically dispose of the bomb. This project is mimicked using Proteus.

The bomb squad's defence and safety could be improved, according to Anisha Cotta and Rajat Desai [2]. At the controlling spot, a bomb technician commands the robot. Data from the website is sent and received using a Bluetooth module.

Chaitrali Jadhav, ShamliGibile [3] suggested using an Android app to control the entire system. WiFi device and microcontroller receive commands from Android application. The Android application also supports robotic arm commands. Accurate site data is recorded with a night vision camera.

Priti pai, Saurabh Mahowadiwar,[4] proposed Bluetooth serial communication with a robot. The robot is connected to Bluetooth, and an Android application gives commands.

The professionals in the bomb squad might be able to operate the motorized robot by using a mobile phone, according to Abhilash. V and PK.Mani [5]. An Android app is used to control the computerized arm. One uses the Blynk app.

3.Proposed System:

This proposed system consists of two modules one is detecting and the other one is diffusing. The robot location is tracked using the GPS module and GSM module[Fig.3].[7] As the device moves the ultrasonic sensor checks the obstacles and clears the way.

When the metal detecting sensor detects something, the camera captures its photage and sends it to the server for the conformation. If the detection is successful then it checks its other functions like temperature, types of gases present etc. [Fig.10] Now the robotic arm performs the actions that are commanded manually it performs actions like picking, placing, cutting etc. To run the robot an android application is developed which contains the keys like left, right, up, down etc. The android application also helps the robot to be in motion by controlling its motor. The android application is connected to the robot bluetooth module, all the actions that are performed are kept in track in thingspeak.

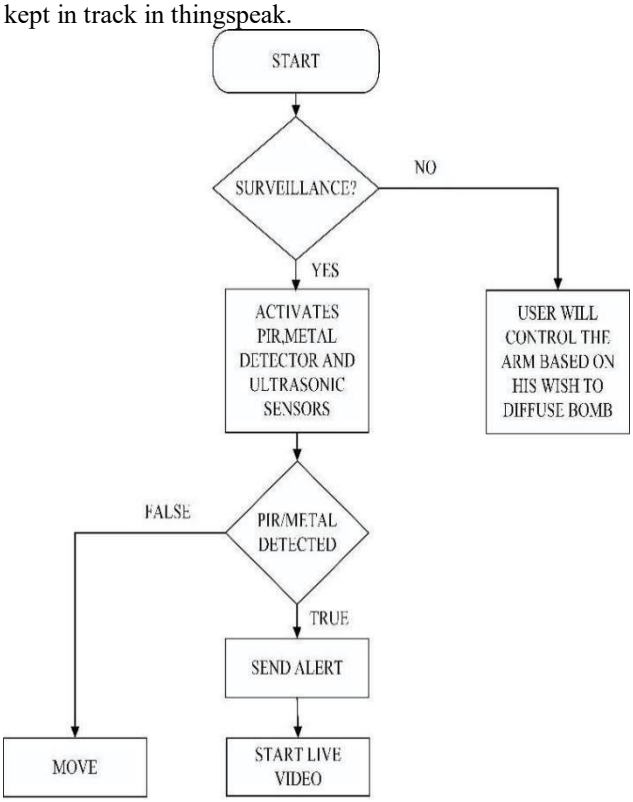

Fig.1 Implementation of the proposed system

3.1.Arduino Uno Board

The free and open-source computer hardware and software organization Arduino was set up by its user base. Arduino develops and manufactures kits to make electronic gadgets that can be applied for managing the real environment.

A number of instances of distinct Arduino boards comprise the Arduino Uno, Arduino NG, Decimilia, Duemilanove, Mega 2560, Mega ADK, and Arduino LilyPad.

The experiment made utilizes the Uno R3 variant of the Arduino microcontroller board[Fig.2], which is based on the ATmega328. It includes a rest button, six analogue inputs, a crystal oscillator with a frequency of 16 MHz, a USB port, a power jack, and 14 digital I/O pins, six of which can be used as outputs for PWM. It is supplied with everything required to support a microcontroller; to get started, choose among using a battery or an AC-to-DC converter to power it instead of linking it to a computer with a USB cable. The USART, I2C, and SPI serial communication types found on the Arduino board in this paper, the board will use the I2C protocol to communicate with the compass and the UART protocol to communicate with the GSM board.

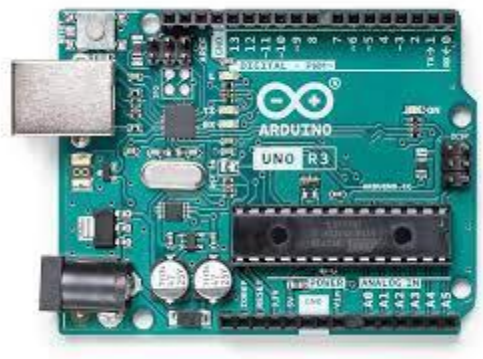

Fig.2 Arduino Uno Board

3.2.GSM Module

[8] The SIM900 GSM/GPRS Shield gives an approach that uses the GSM cell phone network for gathering data from an isolated location. The shield provides three various methods to accomplish this.

The GPRS Shield offers the Shortest Text Service, Phone Call Service, plus GPRS Services, and each of these services has the same form factor (and connector) as an ordinary Arduino Board. Through its USART and the use of fundamental AT instructions, the GPRS Safeguard is organized and managed. The GPRS Shield depends upon the SIM900 unit from SIMCOM Limited and functions analogous to a cellphone.

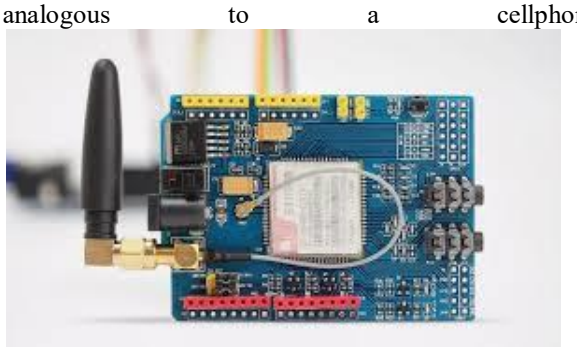

Fig.3 GSM Module

3.3.Metal detecting sensor

An instrument that looks for the presence of metal in the area is called a metal detector. The 12mm Inductive 12V DC Proximity Metal Detector[Fig.4] is used here to find metal objects underwater, underground, and on the surface.

Fig.4 Metal Sensing Sensor

3.4.Raspberry Pi IR Camera

It is a Raspberry Pi-specific Camera setup[Fig.5]. This camera can record video at any time of day or night. It can take pictures and send them to the control room in real time.

Fig.5 Raspberry Pi IR Camera

3.5.Ultrasonic Sensor

When obstacles and other applications need to be found, the ultrasonic sensor[Fig.6] is used. The distance is determined by using ultrasonic waves. This comprises of the wave's generator and receptor. Every object on earth has a unique material feature. The wave energy appears in the received signal depending on if the right thing has been touched by the created signal.

Fig.6 Ultrasonic sensor

3.6.GPS Module

Using the API of Google for directions and an automated set-up technique, this section is used to automate the robot's movement.[9] The Global Positioning System (GPS), a satellite-based mapping system[Fig.7], provides time and location-related data. The method is free to use for anyone with a GPS receiver and clear views of at least four GPS satellites. A GPS receiver recognizes its position by properly synchronizing the data carried by GPS satellites. Today, GPS is used widely and a regular part of smartphones.

Fig.7 GPS Module

3.7.Thingspeak

A cloud-based IoT analytics service called ThingSpeak lets you aggregate, visualize, and analyze live data streams. Data uploaded by your devices to ThingSpeak can be instantly visualized with ThingSpeak. You can process data as it arrives and perform online analysis with ThingSpeak's ability to execute MATLAB code. Prototyping and proof-of-concept IoT systems that require analytics frequently make use of ThingSpeak.

3.8.Temperature sensor

The DHT11 [Fig.8], a temperature and moisture sensor, provides electronic information. DHT11 binds with an embedded system such an Arduino to achieve a swift result. It is a temperature plus dew gauge that is reliable, robust, and inexpensive. No digital input pins are necessary because it relies on a thermistor and capacitive humidity sensor that recognizes the air around it and sends a digital signal to the data pin. There are libraries and example code for Arduino and Raspberry Pi, and it is simple to use. This module simplifies the interface of a DHT11 device [Fig.7] to a microprocessor by providing a pulling resistor for usage with the sensor. The sensor simply needs the three connections Output, Gnd, and Vcc.

Fig.8 DHT11 Sensor

3.9.Gas sensor

Electronic devices that are capable of detecting and identifying various kinds of gases are referred to as gas sensors, or gas finders [Fig.9]. They are typically used to distinguish between gases that are dangerous and gases that are sensitive, as well as to determine gas fixation.[11] Gas detection devices are used in assembly lines and production plants to find carbon monoxide, smoke and gas leaks in homes. Both portable and fixed gas sensors are available in an extensive variety of sizes, ranges, and detecting capabilities. They are often accompanied by a distinct warning or interface and are frequently required by a broader linked structure, such as security or

dangerous substance systems. Gas sensors require more frequent adjusting than other types of sensors since they are frequently reacting with air and other gases.

Fig.9 MQ 135 Gas Sensor

3.10.Gripper Arm

Grippers enable robots to grasp and hold objects. Utilizing grippers and a collaborative (or "cobot") current robot arm, companies can automate essential processes like machine up keep and gathering data, selection, and detection. Like the human hand, think of grippers as being near the end of the arm. Thanks to their skills, you may pair arm strength with hand flexibility. Cobots can do a wide range of functions with the help of this combination, such as stack large boxes or handle small, fragile electrical elements.

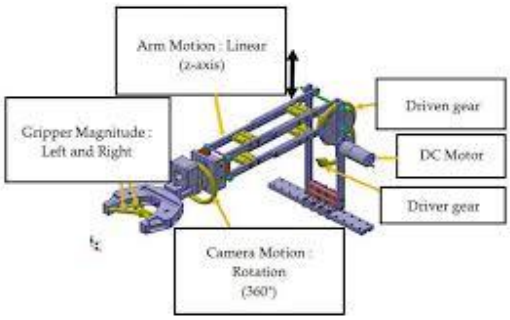

Fig.10 Gripper Arm

3.11.Bluetooth Module

Email is rapidly replacing cable connections in terms of hardware and communication. It is intended to substitute for link associations[12]. The HC-05 uses sequential correspondence to communicate with the devices. It tends to be used to link miniature devices, such cell phones, in order to swap data over a brief distance. It makes advantage of the 2.45 GHz frequency band. The data rate of exchange can vary by up to 1 Mbps across a 10 metre distance. The HC-05 module[Fig.11] may run on a 4-6V power source. It continues to support baud rates of 9600, 19200, 38400, and 57600, among others. When utilized in Master-Slave mode, it is unable to send or receive data from external sources.

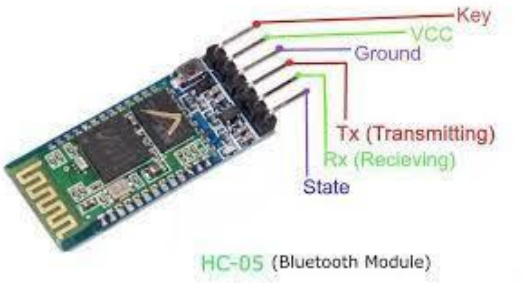

Fig.11 HC-05 Module

4.Result:

Controlling keys of the motor

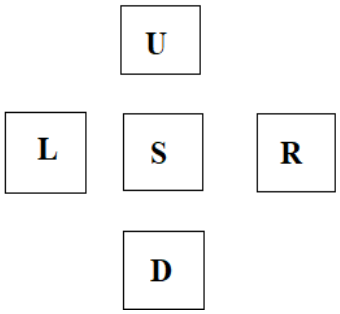

Fig.12 controlling keys in android application

U-To move front

D- To move back

L- To move left

R- To move right

S- To stop the motor

Whenever the Metal detector picks up something and gives the user a picture of it. The picture is verified and the bomb is diffused manually by the user. The temperature sensor, Gas sensor readings are shown as below

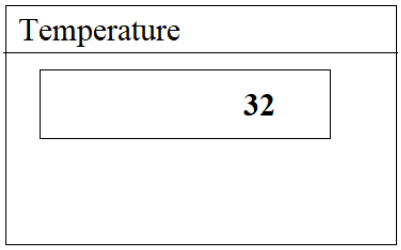

Fig.13 Output of the temperature

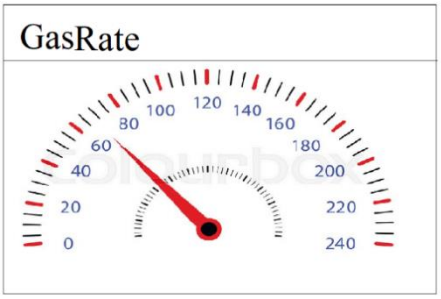

Fig.14 Output of the Gas rate

All the records are kept in track in things speak module for the future references.

5.Conclusion:

It is our duty to rescue the lives of our country's army men and citizens, as the government is unable to afford the demining process. This paper describes a low-cost IoT-based bomb diffusion surveillance robot. Security for historical sites, financial institutions, and other control applications is made possible by the proposed approach with minimal modifications. By utilizing this technology, we are able to detect the bomb as promptly as could reasonably be expected and effectively destroy it, allowing us to almost certainly save human lives. In this way, a planned robot could replace the police and military bomb disposal crews.

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