

EXPLOSIVE DETECTION AND DISPOSABLE ROBOT - VLC TECHNOLOGY USING IOT

Submitted in partial fulfilment of the requirements for the award of Bachelor of
Engineering Degree in Mechatronics Engineering

by

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**DEPARTMENT OF MECHATRONICS ENGINEERING
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SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade “A” by NAAC

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of CH. Hariprasad (38090702) and V. Harish (38090703) who carried out the project entitled "EXPLOSIVE DETECTION AND DISPOSABLE ROBOT (VLC TECHNOLOGY) USING IOT" under my supervision from 01.11.2021 to 10.05.2022.

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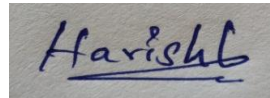
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DECLARATION

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ABSTRACT

The major goal of building this robot is to monitor human activity in combat zones or border regions to limit enemy infiltration. Military personnel faces a significant danger of death when approaching uncharted territory. The robot will be an appropriate machine for the defense sector, reducing human life loss and preventing criminal operations. There will assist all military personnel and armed forces in understanding the state of the land before entering it. This robot consists of a Gas sensor to detect toxic gases, a fire sensor to detect if there is any presence of fire in the robot's path, a motion detection sensor to detect if there's any enemy presence in the way of the robot, a metal detector sensor to detect the landmines, all the sensor's parameters will be transmitted from the robot using VLC technology which is a novelty of this project. In this vehicle, the signals transmitted from the user's device are used for vehicle motion. This information is sent back to the user's device via a wireless system.

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CHAPTER 1

INTRODUCTION

1.1 EXPLOSIVE DETECTION

Explosive detection is based on a range of technologies that focus on either bulk explosives or explosive traces. Bulk explosives can be detected in two ways: indirectly by imaging the explosive charge, detonators, and wires, and directly by detecting the chemical composition or dielectric properties of the explosive substance. The gases produced from the explosive or explosive particles that are deposited on nearby surfaces are used to detect traces. Explosive detection is a difficult task, and combining several techniques can improve sensitivities and selectivities. There are a variety of explosive detection systems that have been proposed, are being researched, or are now in use. On the web, there is a recent assessment of current technologies and goods.

1.1.1 Types of explosive detection

When it comes to explosive detection, there are a lot of technologies that are existing in the current scenario

1.1.1.1 BULK DETECTION

In standoff detection scenarios, imaging is a common tool. Most bombs include distinct spatial features and metal components that are uniquely formed, such as wires, detonators, and batteries. For X-ray and microwave imaging techniques, explosive dielectric constants provide at least a limited separation from the background. In a set of spectral bands, the reflection, absorption, and scattering of various explosives may be classified, and this information can be utilised as a database for picture analysis. This section covers a variety of imaging techniques that employ radiation with wavelengths ranging from radio waves to gamma rays. Imaging is used in the majority of bulk detection techniques that have the capability for standoff detection.

1.1.1.2 X-RAYS

For many years, X-rays have been used to inspect bags and cargo containers for bombs and other contraband. Because X-ray radiation is ionising, it poses a health risk to those who are exposed to it. These health concerns, on the other hand, may not be a deterrent to imaging out to standoff distances of 10 to 20 metres. Transmission A detector on the opposite side of the target from the transmitter is required for X-ray imaging. A low-cost plastic sheet might be used as the detector, which would be monitored by a low-cost camera connected to a data analysis base through a wireless link. Detectors and cameras that are inexpensive could be hidden and replaced if they are damaged. Because of their strong X-ray absorption, transmission images have good resolution and can identify the forms of shaded objects.

1.1.1.3 INFRARED

Clothing, explosive bundles, and most other materials are opaque to radiation in the infrared (IR) spectral spectrum (wavelengths between 1 and 10 microns). Thermal IR radiation is passively emitted by the body or other things near room temperature. Thermal radiation can be easily detected with simple, low-cost infrared imaging equipment. Even with temperature disparities beneath a surface, objects differing marginally in their surface temperature are easily identified. Because the clothing covering the explosive pack should be at a slightly different temperature than clothing closer to the skin, infrared imaging is of great importance in suicide bomber scenarios. However, infrared imaging in outdoor situations is more difficult due to air currents and other radiation sources, making thermal variations more difficult to detect.

1.1.1.4 TERAHERTZ

As the wavelength of the radiation climbs to the terahertz region, wavelengths greater than 300 microns correspond to 1-THz frequencies, clothing and many other things become almost transparent. The use of imaging in this area enables for the identification of explosives hidden beneath garments while avoiding the use of ionising radiation. There is hope that explosives will be discovered to have the ability to identify spectral features in this spectral region, so that explosive identifiers will be more than basic shapes with modest dielectric index disparities. Due to the bending

and twisting modes of explosive molecules, they have distinct spectrum characteristics. However, in the solid and liquid phases, the sharp spectral lines associated with these modes in the gas phase will most likely be greatly widened. They can't be used to make a one-of-a-kind identification. It's also possible that the granularity or crystal formations of explosives could boost visual contrast through radiation scattering.

1.1.1.5 TRACE DETECTION

The task of detecting traces at standoff distances is particularly difficult. Many popular explosives have very low saturated vapour pressures (approximately 10 parts per billion [ppb] for TNT and 10 parts per trillion [RDX] and pentaerythritol tetranitrate [PETN]). In many instances, the explosion is contained in a vast volume of air, at least the size of a big room. The saturation vapour pressure of a gas in a huge volume of air will eventually be established, but it will take many hours. The actual concentration of explosive molecules is determined in most explosive detection scenarios by air currents, charging of explosive molecules, and adsorption onto adjacent surfaces. Even if the chances of molecules clinging to surfaces are far less than one in a million, the surface area is enormous. Several explosive compounds have a high electronegative charge (i.e., they have a high probability of attaching an electron and becoming charged). In the limited airspace near the explosive, both air currents and significant electric fields in the air will generate plumes of explosive molecules, similar to smoke drifting from a cigarette or scent from a rose. The actual concentration of molecules in these plumes is likely to be 100 to 10,000 times lower than the saturated vapour pressure predicts. This makes detecting explosive vapours extremely difficult.

1.1.2 IMPORTANCE OF EXPLOSIVE DETECTION

Because explosive-based weapons are inexpensive, easy to deploy, and can cause massive damage, explosive-based terrorism has exploded in popularity in recent years. Due to various factors, such as the low vapour pressures of most explosives, the rapid development of new explosive compositions, and concealment and weapon delivery techniques, detecting explosives is a difficult process. The most common method for detecting explosives is to collect vapour or particle samples and analyse them with a sensitive sensor system. There are numerous methods for detecting

trace explosives now available. Ion mobility spectrometry (IMS), mass spectrometry (MS), and gas chromatography (GC) are the most prevalent, followed by detection with a sensitive sensor. The majority of these gadgets, on the other hand, are big, pricey, and need lengthy processes. Due to these drawbacks, such systems are only used in a few strategic sites, such as airports and government buildings. When considering not only airports, where the environment for sensing and detection is relatively controlled, but also the virtually uncontrollable entry points to public places, transportation networks, infrastructures, and road networks with unpredictable vehicular and pedestrian traffic, additional complications arise. The only way to protect against explosive-based terrorism is to deploy a large number of small sensors that are sufficiently sensitive and selective, affordable, and mass-producible. The proven strategy for detecting explosive traces in air is to:

1. collect air and particulate samples from around or on the suspected object;
2. preconcentrate the explosive molecules on a sorbent material;
3. adsorb the released molecules from the preconcentrator on a signal transduction sensor element for detection; and
4. analyse, characterise, and report the data.

Chemical identification with a selective agent and signal transduction are key components of detection. The signal is then processed for reporting in an integrated system. High sensitivity, selectivity, reversibility, and real-time operation are the most significant performance characteristics of explosive sensors. Because of the minimal number of molecules that may be collected due to their low vapour pressures, explosive detection necessitates extremely high sensitivity and low limits of detection (LODs). To have a low rate of false positives, high selectivity is required. The sensor should be reversible at room temperature to allow for continuous operation. For efficient operation, these sensors should have quick detection and regeneration times. Finally, because of the wide range of terrorist threats including explosives, the sensors should be able to be deployed in large numbers. At the moment, existing sensor platforms are unable to meet these demanding requirements. Nanoscience-based sensors, on the other hand, provide a clear path to the development of trace explosive sensors that meet these requirements.

1.2 Why VLC?

Visible light communication (VLC) is a type of data transfer that employs visible light between 400 and 800 THz (780–375 nm) to transmit information. VLC is a type of optical wireless communication that falls under the category of VLC.

Signals from light sources are normally received by specially built electrical devices containing a photodiode, though in rare circumstances a mobile phone camera or a digital camera will suffice. The image sensor in these devices is actually an array of photodiodes (pixels), which may be preferable in some applications than a single photodiode. Multi-channel (down to 1 pixel Equals 1 channel) or spatial awareness of various light sources may be provided by such a sensor. Because light-producing equipment (such as indoor/outdoor lamps, TVs, traffic signs, commercial displays, and car headlights/taillights) are utilised everywhere, VLC can be employed as a communications channel for ubiquitous computing.

1.2.1 MODULATION TECHNIQUES

Light modulation is necessary for data transmission. Modulation is a method of representing different symbols with a light signal. To decrypt the information. In contrast to radio transmission, VLC modulation necessitates the modulation of the light signal around a positive dc value, which is responsible for the lamp's lighting. As a result, the modulation will be an alternate signal around the positive dc level, with a high enough frequency to be undetectable to the human eye. Because of this signal superposition, a VLC transmitter typically requires a high-efficiency, higher-power, slower-response DC converter for the LED bias that will provide lighting, as well as a lower-efficiency, lower-power, but faster-response velocity amplifier to synthesise the required AC modulation. Modulation can be done in a number of ways.

1.2.1.1 Single-Carrier Modulated Transmission

Single-Carrier Modulated Transmission refers to modulation techniques that have been used in conventional modes of transmission like radio. When a sinusoidal wave is added to the illumination dc level, digital data can be encoded in the wave's characteristics. Symbols corresponding to each value are conveyed on the light link by keying between two or more different values of a specific feature.

Amplitude Shift Keying (ASK), Phase Shift Keying (PSK), and Frequency Shift Keying are some of the approaches that can be used (FSK). FSK, out of the three, can transmit higher bitrates since it allows more symbols to be easily discriminated during frequency switching. Quadrature Amplitude Modulation (QAM) is another approach that has been considered, To enhance the amount of symbols possible, both the amplitude and phase of the sinusoidal voltage are simultaneously keyed.

1.2.1.2 Multi-Carrier Modulated Transmission

Multi-Carrier Modulated Transmission is similar to Single-Carrier Modulated Transmission in that it incorporates two or more sinusoidal waves that are modulated for data transmission. This is one of the most difficult and complex modulations to synthesise and decode. However, it has the advantage of excelling in multipath transmission, when the receptor is not in direct view of the transmitter and hence relies on light reflection in other barriers for transmission.

1.2.1.3 Pulse-Based Transmission

Pulse-based transmission refers to modulation systems in which data is encoded on a pulsed wave rather than a sinusoidal wave. Unlike sinusoidal alternating signals, which always have a null periodic average, pulsed waves with high-low states have inherit average values. The Pulse-Based Transmission modulations gain two major benefits as a result of this:

It can be implemented using a single high-power, high-efficiency, slow-response dc converter and a fast-speed power switch to deliver current to the LED at predetermined intervals.

Because the average value is determined by the data signal's pulse width, the same switch that controls data transmission may also control dimming, considerably simplifying the dc converter.

These dimming-capable modulations have been standardised in IEEE 802.15.7, in which three modulation schemes are described: On-Off Keying (OOK), Variable Pulse Position Modulation (PPM), and Colour Shift Keying (CSK).

1.2.1.4 Variable Pulse Position Modulation

Variable Pulse Position does the same thing as Variable Pulse Position, except it encodes the symbols on the pulse position inside the data period. The transmitted symbol is standardised as logical low '0' if the pulse occurs at the start of the data

period, and logical high '1' when the pulse occurs at the conclusion of the data period. Because the information is encoded at the location of the pulse within the data period, both pulses can and will have the same width, hence there is no need for a compensation symbol. The transmitting algorithm is in charge of dimming, and it chooses the width of the data pulses accordingly. When opposed to OOK, VPPM is slightly easier to encode due to the lack of a compensating pulse. The VPPM technique's simplicity is compensated for by a slightly more sophisticated demodulation. This decoding complexity stems mostly from the fact that each symbol's information is encoded at separate rising edges, making sampling in a microcontroller more difficult. Furthermore, in order to decode the location of a pulse inside a data period, the receptor must be synced with the transmitter in some way, knowing when a data period begins and ends. Because of these qualities, demodulating a VPPM signal is slightly more complex.

1.3 LI-FI

Li-Fi (sometimes spelled LiFi) is a wireless communication technology that sends data and location between devices using light. Harald Haas coined the phrase during a global address in Edinburgh in 2011.

In technical terms, Li-Fi refers to a light communication system that can transmit data at fast speeds across the visible, ultraviolet, and infrared spectrums. For the time being, data transfer in visible light can only be done using LED lamps. The technology is comparable to Wi-Fi in terms of end-use, with the main technical distinction being that Wi-Fi uses radio frequency to generate a voltage in an antenna to transfer data, whereas Li-Fi employs light intensity modulation to send data. Li-Fi has the potential to carry data at speeds of up to 100 Gbit/s in theory. The capacity of Li-Fi to operate safely in environments that are otherwise susceptible to electromagnetic interference (e.g., airline cabins, hospitals, and military) is a benefit.

1.3.1 TECHNOLOGY

In a similar way to Wi-Fi, Li-Fi is a derivative of optical wireless communications (OWC) technology, which uses light from light-emitting diodes (LEDs) as a medium to enable network, mobile, high-speed communication.

Visible light communications (VLC) works by switching the current to the LEDs off and on at a very fast rate, too fast for the human eye to notice, therefore there is no

flickering. Although Li-Fi LEDs must be turned on to transfer data, they may be dimmed to below human vision while still providing enough light to transmit data. Li-Fi does not require a straight line of sight to broadcast a signal; light reflected off walls can attain 70 Mbit/s.

Li-Fi has the advantage of not creating electromagnetic interference in electromagnetic sensitive places such as airline cabins, hospitals, and nuclear power plants. While the US Federal Communications Commission has warned of a future spectrum crisis due to Wi-Fi's capacity, Li-Fi has virtually no capacity limitations. Researchers were able to achieve data speeds of more than 224 Gbit/s, which was far quicker than average fast broadband in 2013. At the 2014 Mobile World Congress in Barcelona, Pure LiFi unveiled the Li-1st, the first commercially available Li-Fi system.

Bg-Fi is a Li-Fi system that consists of a mobile application and a basic consumer product with a colour sensor, microcontroller, and embedded software, such as an IoT device.

1.3.2 STANDARDS

Li-Fi, like Wi-Fi, is wireless and employs similar 802.11 protocols, but instead of radiofrequency waves, it uses ultraviolet, infrared, and visible light communication, which has a far higher bandwidth.

VLC is based in part on communication technologies developed by the IEEE 802 workgroup. The IEEE 802.15.7 standard, on the other hand, is out of date because it fails to take into account the most recent technological advances in the field of optical wireless communications, particularly the introduction of optical orthogonal frequency-division multiplexing (O-OFDM) modulation methods that have been optimised for data rates, multiple-access, and energy efficiency. The arrival of O-OFDM necessitates a new push for optical wireless communications standardisation. The standard can send music, video, and multimedia services at high enough data rates. It considers the mobility of optical transmission, as well as its compatibility with artificial illumination in infrastructures and the potential for interference from ambient lighting. The MAC layer, like the TCP/IP protocol, allows the link to be used with other layers. Three PHY layers are defined in the standard, each with a distinct rate:

- The PHY 1 was designed for outdoor use and operates at speeds ranging from 11.67 kbit/s to 267.6 kbit/s.
- The PHY 2-layer allows data speeds of 1.25 Mbit/s to 96 Mbit/s to be achieved.
- The PHY 3 is utilised for a variety of emissions sources, and it employs a modulation technique known as colour shift keying (CSK). PHY III can deliver data at speeds ranging from 12 to 96 megabits per second.

On-off keying (OOK) and variable pulse position modulation are the modulation formats recognised by PHY I and PHY II (VPPM). The clock is included in the transmitted data using Manchester coding for the PHY I and PHY II layers, which represents a logic 0 with an OOK symbol "01" and a logic 1 with an OOK symbol "10," all with a DC component. In the event of an extended run of logic 0's, the DC component prevents light extinction.

From January 7–10, 2014, the first VLC smartphone prototype was shown at the Consumer Electronics Show in Las Vegas. Small screens, such as watches and smartphones, can be made solar-powered by adding a clear thin coating of crystal glass. During an average day, smartphones might get 15% more battery life.

In 2015, the first smartphones with this technology should be available. VLC signals, as well as the smartphone camera, can be received on this screen. These screens cost between \$2 and \$3 per smartphone, which is far less than most new technology. A VLC system for store shoppers has been created by Signify Lighting (previously Philips Lighting). They must first download an app to their smartphone, which then connects to the store's LEDs. Based on whatever they are on and what they are looking at, the LEDs can detect where they are in the shop and provide them with relevant coupons and information.

1.3.3 APPLICATION

The communications cannot pass through walls or doors using the short-wave radiation employed by Li-Fi. This increases network security and makes it easier to manage network access. Access to a Li-Fi channel is limited to devices inside the room as long as transparent objects like windows are covered.

1.3.3.1 Home and building automation

Many experts predict that Li-Fi will become increasingly popular in homes as a result of the technology's promise for faster speeds and security benefits. Because light is used to convey data, the network can be limited to a single physical room or building, reducing the possibility of a remote network attack. Though this has more implications in the workplace and other sectors, home automation, which demands the exchange of large amounts of data over a local network, may push home users forward.

1.3.3.2 Underwater application

The bulk of remotely driven underwater vehicles are controlled via wired connections (ROVs). The length of their cabling limits their operational range, and other factors such as the cable's weight and fragility may also limit them. Because light can travel across water, Li-Fi-based communications could provide significantly greater mobility. Li-utility Fi's is limited by the distance light can penetrate water. Significant amounts of light do not travel more than 200 metres. Beyond 1000 metres, there is no light.

1.3.3.3 Aviation

Effective data transfer is possible under airborne situations, such as on a commercial passenger airline utilising Li-Fi. This light-based data transmission will not disrupt the aircraft's radio-based electronics, such as the radar.

1.3.3.4 Hospital

Li-Fi systems could be a superior way to send high-volume, low-latency data across networks. Light waves not only have a faster speed, but they also have fewer side effects on medical instruments. A possible example of this is the usage of wireless devices in MRIs and other radiosensitive procedures. The location of assets and staff is another LiFi application in hospitals.

1.3.3.5 Vehicles

To improve road safety, vehicles could communicate with one another via front and backlights. Information regarding current road conditions can also be conveyed via traffic signals and street lights.

1.3.3.6 Industrial automation

Li-Fi can replace slip rings, sliding contacts, and small cables, such as Industrial Ethernet, whenever data has to be carried in industrial sectors. Li-Fi is also an option to typical industrial Wireless LAN protocols due to its real-time capabilities (which are frequently required for automation processes). Fraunhofer IPMS, a German research institute, claims to have created a component that is ideal for industrial applications involving time-sensitive data transfer.

1.3.3.7 Advertising

Street lighting can be used to display advertisements for nearby businesses or attractions on mobile devices as people walk past. A shopper entering a store and passing by the store's front lights can see current specials and promotions on their cellular smartphone.

1.4 OBJECTIVES

The primary goal of this robot's development is to monitor human activities in combat zones and border regions in order to limit enemy infiltration. Military personnel face a significant danger of death when entering uncharted area. The robot will be an appropriate machine for the defence sector, reducing human life loss and preventing criminal operations. There will assist all military personnel and armed forces in understanding the state of the land before entering it. This robot has a gas sensor to detect toxic gases, a fire sensor to detect fire in the robot's path, a motion detection sensor to detect enemy presence in the robot's path, and a metal detector sensor to detect landmines. All of the sensor's parameters will be transmitted from the robot using VLC technology. The signals sent by the user's smartphone are used to move the car in this vehicle. This information is wirelessly transmitted back to the user's smartphone.

CHAPTER 2

LITERATURE SURVEY

AKinde.O.K et al (2019), globally, the composite terrorism landscape has continued to pose threats to national and international economies. Most detection systems are ineffective and do not provide reliable sensing and evacuation results. The time-consuming search approach of inspection is not ideal for mission-critical environments. Motivated by these concerns, this paper presents CTD for the detection of dangerous transportation modes associated with an improvised explosive device (IED).

A real-time embedded system framework (RTESF) is introduced for efficiently coordinating the activities of bomb sensing, signal transmission, and reception. The scheme triggers device dynamics and kinematics such as robotic-based trap units. It also provides high-speed monitoring and identification of suspicious objects as well as marked areas. In the design, both hardware and software integration is realized using a multi-level control architecture.

Ashok Kumar.M et al (2018), this project describes about the design, construction and fabrication of multi-purpose field surveillance robot that can be used for land mine detection, toxic gas sensing and temperature and humidity sensor monitoring in war fields without putting serious manual risks. The land mine detector can detect covered metals, gas sensor can detect toxic gas attacks and the robot can be controlled wirelessly by Android phone. The robot uses Arduino Uno microcontroller to gather sensor information and NodeMCU WiFi to interface the controller and the robot. Based on the input information from Android application, the robot can make moved and climbed on any terrains. The distinguishing feature of our project from traditional ones is that the integrated design of Android phone operation and multiple IoT cloud servers. All robotic sensor information are delivered to cloud servers and viewed through Webpage. This way the robot can be used both at Military war fields and monitored at Military headquarters simultaneously. This is a novel attempt to integrate field robots and IoT technologies at an expandable mode of design. Additional enhancement of the design made it an outstanding choice for deployment

and use in dangerous zones infested with land mines and other hazardous metallic items.

Chaitrali Jadhav et al (2018), this innovative system is made for operations that involve high risk for humans to enter, especially for some criminal cases, and may prove very beneficial for the military area for spying purposes. This system saves the valuable life of our soldiers. This system makes use of a robotic arm as well as a robotic vehicle to enter into army areas. The whole system is controlled via an android application. In the case of a military bomb disposal operation, a client will connect to the server using a TCP/IP link. Once a client connects to the server, a client can issue commands to move the robot in forwarding, backward, right, and left directions.

Charisma.S et al (2018), this paper describes the design and implementation of an electronic metal detector-equipped remote-controlled robot that can be used in land mine detection without harming human beings. It can detect covered metals using a metal sensor and also the toxic gases used by the attackers by using a gas sensor. In the existing system, the wireless communication range is limited. But in our design, we use Wireless-Fidelity (Wi-Fi) to increase the range of communication. Software programs are integrated into the system to test and experiment with the ideas that had been formed. A Node MCU is used in the robot for Internet connectivity. The robot can be controlled via a Blynk App developed in the android platform. As directed by the commands received from the android app, the robot can make a regulated movement.

Devendra.R.Bodkhe et al (2016), this paper is for presenting two technology which when combined can form tremendous useful devices for defense systems and ultimately society because the robot is a unique technology to serve society in different applications and a different field so we all know the importance of robots nowadays in society and developing technology the number of robots Used worldwide is constantly increasing. They are more and more present in different workplaces such as dangerous areas, processing operations, medical environments, military, manufacturing inaccessible areas, etc. Again, we have one unique communication technology now that is IOT this paper will explain mostly IoT technology because IoT is not only just a technology it is phenomenal ...Now the Internet is being used to connect various objects such as cars, sensors, controllers,

TVs, machinery, transport containers, and electrical appliances, creating the Internet of Things (IoT).

The networked and user interfaced robots, such as rescue robots, human assisting robots, health care robots, and robots for military applications. The evolution and growth of the Internet because a technology we can control robots with high distance, high speed, and high accuracy. , solution on all communication and control over the internet which is wireless and we can optimistically look forward to an IOT-assisted world that is connected, smarter – and better. Disposing any explosive materials is an extremely dangerous and risky job. bomb disposal is also an extremely delicate job,

Dinesh Tharun .S et al (2020), this paper provides the estimation through drones for surveillance and bomb diffusion using actuators. The proposed model is composed that is lightweight, portable, and user-pleasant with reduced complexity. The new glove system is wi-fi and self-contained machine that's established at the user's arm to control the motion of the robot. The device is not restricted to the variation inside the finger sizes thereby imparting accuracy and comfort for the robotic control. The system is ready with bomb detection and diffusion mechanism. Once the presence of bomb/Metal is detected by using robotic, it initiates commands to the legal officials and the detected bomb can be subtle from a remote area, it linked direct touch with the bomb. Thus the machine provides high security for the existence of the bomb diffusion squad. The proposed device is noticeably useful in all regions that call for safety and it presents virtual facts in surveillance and diffusion.

Ferreira.H.C et al (2015), this article reviews visible light communications (VLC) technology. It presents the VLC communication system: the transmitter, the channel, and the receiver. The single and multi-channel transceivers are presented. The channel for a system that uses single light-emitting diodes (LED) and the matrix representing the multi-color channel are discussed. Various modulation schemes are reviewed. Basic techniques used to implement a VLC system are highlighted and different causes of impairment are underlined. A word is given on the standardization of the VLC technology. Numerous applications of VLC technology are given. Challenges for VLC practical implementation and commercialization are reviewed. Advances in VLC and future research issues are discussed.

Keerthana.S et al (2019), Countless number of news items dealing with injured trained personnel or military people who loses their lives during defusing bombs appears daily in newspapers around the world. Here a robotic arm is designed to detect and dispose a bomb which is located around the range of 100m with safety and to provide a security for the bomb disposal squad against risks. The designed robot is manually controlled by the user through Personal Computer (PC).The buzzer alarm when the sensor detects a metal. The metal is examined with the help of the wireless camera that checks whether it is a bomb or not. If the detected metal is a bomb then the user controls the robot through PC and disposes the bomb. Arduino Mega board, DC motors, Robotic arm, wireless camera, Buzzer forms a part of designed robot. Initially setup is simulated using proteus software and then entire hardware setup is controlled through personal computer.

Nandagopal Rathod et al 2020 this project is very beneficial in areas where there is a high risk for humans to enter. This system makes use of a robotic arm as well as a road biotic vehicle which helps not only to enter an area involving high risk but also to pick whatever object it wants to. The system also includes a night vision camera which will not only allow viewing whatever will be recorded in day time but also during the night. The whole system is controlled via RF remote. The system sends commands to the receiving circuit mounted on the vehicle through push buttons. The receiving circuit involves a microcontroller and a receiver that receives commands sent by the transmitting circuit. At first, the system is set to control the movement of the vehicle. To set the system in a move that operates the arm. At first, the user needs to press the push buttons for moving the vehicle in whichever direction it wants i.e., forward, backward, right, or left direction.

Narendra Prasad (2017), this project presents a moving robot with metal detecting and IoT communication and it is designed and implemented with Raspberry pi in embedded system domain. Experimental work has been carried out carefully. The result shows that higher efficiency is indeed achieved using the embedded system. The proposed method is verified to be highly beneficial for the safety purpose.

Nikhil.C.Y et al (2018), armed surveillance vehicles are autonomous vehicles that can be controlled and directed to accomplish tasks. Armed surveillance vehicles or robots promise to increase the operational range of the armed forces while reducing the exposition of personnel to hazardous conditions. These robots are favorable in

complicated, rigid special situations where risk-bearing for army person is high. They have traditionally been in use for aerial surveillance and ground-based explosive ordnance disposal. Following the ongoing progress in research and technology. Armed surveillance vehicles have the potential to play a much more versatile role in future conflicts. The use of such systems is already expanding into reconnaissance, surveillance, and target acquisition scenarios. The major challenge is to increase the range and efficiency of communication for controlling and coordinating the vehicle, to reduce cost, and to avoid human exposition to hazardous This performance, however, is primarily dependent on how effectively a human operator can supervise and control the unmanned system using a given human-machine interface. In this paper, we made use of the internet of things to control and coordinate vehicle for their mobile and efficient work. We believe that this approach can support the acceptance and use of it based armed surveillance vehicle.

Pankaj Agrawal et al (2019), this paper is for presenting two technology which when combine together can form and tremendous useful devices for defense system and ultimately society because robot is an unique technology to serve society in different application and in different field so we all knows important of robot now days in society and developing technology the number of robots Used worldwide is constantly increasing. They are more and more present in different workplaces such as, dangerous areas, processing operations, medical environments, military, manufacturing inaccessible areas etc.....again we have one unique communication technology now that is IOT this paper will explain mostly IOT technology because IOT is not only just an technology it is an is phenomenal ...Now the Internet is being used to connect various objects such as cars, sensors, controllers, TVs, machinery, transport containers and electrical appliances, creating the Internet of Things (IoT). The networked and user interfaced robots, such as rescue robots, human assisting robots, health care robots and robots for military applications The evolution and growth of the Internet because a technology we can control robot with high distance, high speed and high accuracy, solution on all communication and controlling over internet which is totally wireless and we can optimistically look forward to an IOT-assisted world that is connected, smarter – and better. Disposing of any explosive materials is an extremely dangerous and risky job .bomb disposal is also an extremely delicate job, The project has been designed keeping in view the current

law and order situation in throughout the world, Everyday hundreds of trained solders are either injured or lose their lives while defusing bombs and for that we can use robot for disposing bomb and can save lives of our people.

Parameshwari.V et al (2021), the bomb detection and diffusion system is presented and technology used in this proposed system produces a powerful device for military field and related sectors. The way of analyzing the Robotic technology takes more risk and time to safeguard the expert's life. Accurate and timely discovery of bombs, energetic resources and their associated composites would give precious information to military personnel's in wide range of military operations. This prototype robot can able to move across suspected explosive area and monitored by camera. This unit is used to identify the obstacles, metal and transferring applicable information regarding this to control station. By using GPS tracking system, suspected bomb location was identified and information will be communicated to the control station then immediately the robot tracks the bomb and dispose it on time. Once the input is received from the user, the data is transferred to the receiver via Bluetooth module and all collected data's can be stored in cloud through IoT technology for further future recommendations.

Prakash.N et al (2021), Robotics has been a staple of advanced manufacturing for over half a century. As robots and their peripheral equipment become more sophisticated, reliable, and miniaturized, these systems are increasingly being utilized for military and law enforcement purposes Mobile robotics play an increasingly important role in military matters, from patrol to dealing with potential explosives.

Rushikesh Uphad et al (2019), this system presents the wireless bomb disposal robot which will help to improve the defense of our nation from terrorists, suicide bombers, and other such activities. The bomb detectors and disposal system work only with the presence of experts. But this way of analyzing takes more time and makes the risk to the life of experts. The Wireless Bomb Disposal Robot uses the control application, at the user end to control the robot remotely using Wireless technology. The bomb technician controls the robot using this application at the control site. The Robot consists of a Base, a Robotic Arm, RPI, and a camera on it. We have used DC motors for the moving robot and the gripper of the robotic arm. As

we are not risking the life of a bomb expert or any other commando. Hence introducing the safest way for disposing of the explosive to save the life of common people. So with the help of the IoT technology **DEFENSE** system also can get an advanced defense device in the form of the **BOMB** deposing ROBOT. As we know disposing of the bomb is a big task for human beings there is always the fear of loss of life in case any mistake's done by the human.

Sarmad Hameed et al (2019), the possibility of the paper developed with a dream to see the spots we wish to see voluntarily in a military field. In this paper, this thought is acknowledged at our fingertips. Robots are assuming a critical job in the military application. The vast majority of the work in the military is unsafe for people. In a war field or safeguard task, a warrior needs to take his specific manner to achieve the goal. The vast majority of the ways are perilous for a warrior. Consequently, the robot replaces the trooper. The paper is done to make a variant of a spying robot that can empower us to watch the place of our advantage. The extent of the robot additionally helps it to be utilized as a covert agent robot. PIC 16F628A and PIC 16F877 are used for controlling all the processes. A CCD camera is used to obtain real-time footage of the field. So, in this way, it will work in the way we acquire robots to work. To monitor the movement of the robot there is a transmitter that is attached to the robot. The explanation for manual control of the robot is that it won't be lost attributable to the nonattendance of human inclusion. Notwithstanding long-range applications, it very well may be utilized as a government-operative robot inside short distances.

Saurabh Mahawadiwar et al (2018), nowadays bomb disposal and diffusing has become very critical and hazardous methods of human life, To overcome the problem, a concept based on a wireless bomb disposal robot is proposed. The bomb is disposed of using the robot which will be controlled through the wireless control module. The control module consists of a transmitter and the actual Robot consists of the receiver module. The receiver module is interfaced with an ARDUINO UNO R3 board. The Robot functions according to the input given via the transmitter. The control module contains an LCD that is interfaced with a wireless video receiver that receives video signals from the wireless camera. The wireless camera is to be placed in the robot near the arm which houses the center shaft motors used for the actual diffusion purpose so that the video captured can be viewed in the LCD which

is placed in the control module. We have used DC motors for the movement of the robotic arm. As we are not risking the life of a bomb squad expert or any other soldier or commando hence introducing the safest way for disposing of the explosive to save the life of common people.

Shekar Goud.D et al (2017), In the present-day scenario, we are facing many threats by bomb blasts so our project is to prepare an unmanned robot that will detect the bomb it will not only detect the bomb but also shows the position of the bomb by using a GPS module and the position of the bomb will be intimated to the specific person through the internet. We are interfacing with a camera to control the robot. Here we are using a metal detector to detect the bomb because we know that any bomb contains some concentration or percentage of metal elements. The global positioning system (GPS) is the only fully functional global navigation satellite system (GNSS). The GPS uses a constellation of between 24 and 32 medium earth orbit satellites that transmit precise microwave signals, which enable GPS receivers to determine their location, speed, GPS was developed by the United States Department of defense This project is much useful for mines detection and surveillance applications.

Yuvaraju.M et al (2017), Nowadays, robots play a major role in all human activities like house maintenance, aerospace, factories, lifting heavy equipment, etc. It will also help to do the risky jobs which cannot do by humans such as mining. The main aim of this project is to extend the use of robots in the national defense system. In that case, the part of detecting explosives made of either metal or chemicals is very important. This project is to implement robots for metal detection for national security. It consists of a metal detecting unit, chemical sensors (which are used to detect chemical composition), line following (IR) sensor (for path following and obstacle detection), and GSM components. These are all controlled and monitored by the Internet of Things (IoT). The Arduino is the main controlling element of the robotic vehicle.

CHAPTER 3

AIM AND SCOPE OF THE PROJECT

3.1 METHODOLOGY

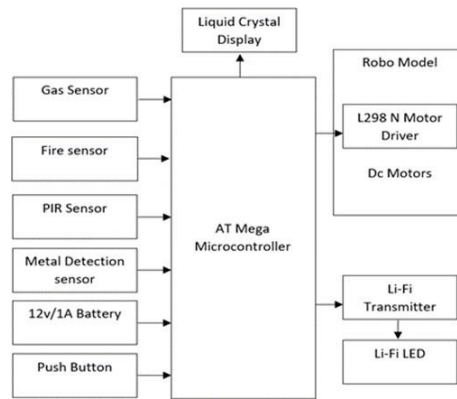


Fig 3.1. Methodology

3.2 EXISTING AND PROPOSED SYSTEM

3.2.1 Existing System

In the current system, the majority of which are used in bigger airports. When in fields as army persons or entities, they must face several dangers to their lives while spying on the enemy or opposing entities. A robot will be more fit for this duty to overcome these notions, reducing the risk of human lives being lost and allowing them to better spy on their adversaries' unlawful maneuvers.

3.2.2 Proposed system:

We show a versatile sensor-based military espionage bot in our suggested project. This robot is equipped with a gas sensor to detect toxic gases, a fire sensor to detect the presence of fire in the robot's path, a motion detection sensor to detect the presence of an enemy in the robot's path, and a metal detector sensor to detect landmines. All of the sensors' parameters will be transmitted via li-fi from the robot.

CHAPTER 4

MATERIALS AND METHODS

4.1 TYPES OF MATERIALS:

4.1.1 MOTOR DRIVER MODULE (L298)

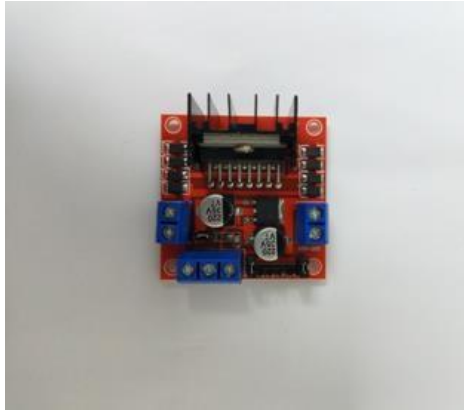


Fig 4.1. Motor driver module

The L298 twin H-bridge chip, which is placed on this handy breakout board along with all essential peripherals, can drive a 2-phase bipolar stepper motor or two DC motors. It is highly suited for robotic applications.

4.1.2 CHARACTER GREEN BACKLIGHT-LCD DISPLAY 16x2 (1602)



Fig 4.2. Character green backlight - LCD display

This is a basic Alphanumeric display with 16 characters and two lines. Green background with black writing. Uses the HD44780 parallel interface chipset, which is very common. The interface code is open source. To connect to this LCD screen, you'll need at least 6 standard I/O pins. The LED backlight is included. Both 4bit and 8bit modes are supported.

4.1.3 SERVO MOTOR:

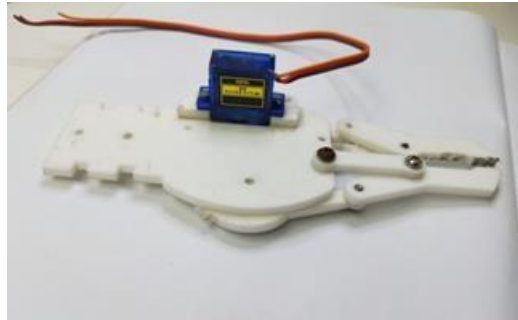


Fig 4.3. Servo motor

Tower Pro SG90 Servo - 9 gms Mini/Micro Servo Motor

4.2 TYPES OF SENSORS:

4.2.1 BLUETOOTH MODULE (HC-05)



Fig 4.4. HC-05 Bluetooth module

The HC-05 Bluetooth module is intended for use in wireless communication. The HC-05 contains a red LED that indicates whether the Bluetooth connection is active or not. Before connecting to the HC-05 module, this red LED blinks in a periodic rhythm.

4.2.2 IR SENSOR

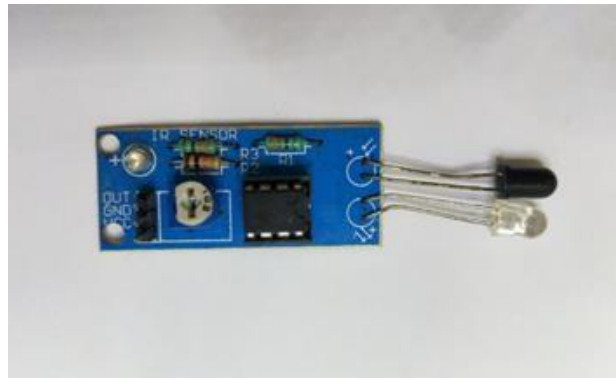


Fig 4.5. IR sensor

Obstacle Avoidance Using Infrared A pair of infrared transmitting and receiving tubes are included in the IR Sensor Module (Active Low). The reflected IR waves are received by the receiver tube when the transmitted light waves are reflected. The processing is done by the onboard comparator circuitry, and the green indicator LED illuminates.

4.2.3 PROXIMITY SENSOR



Fig 4.6. Proximity sensor

A proximity sensor is a non-contact sensor that detects the presence of an object (also known as the "target") when it enters the sensor's field of view. The sensor may detect a target via sound, light, infrared radiation (IR), depending on the type of proximity sensor. Phones, self-driving cars, anti-aircraft systems, and assembly lines all employ proximity sensors.

4.2.4 MOTION SENSOR



Fig 4.7. Motion sensor

If you want to make a device that detects perceive motion and almost always detects whether a human has entered or exited the sensor's range. You can detect motion using the HC SR501 PIR Motion Sensor Detector Module. It's almost often used to detect human movement within the range of the sensor. Sensors such as "PIR," "Pyroelectric," "Passive Infrared," and "IR Motion" are commonly used.

4.3 ARDUINO

Arduino is a corporation, initiative, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for making digital devices using open-source hardware and software. Arduino board designs include a range of microprocessors and controllers and are released under a CC BY-SA licence, while the software is licenced under the GNU Lesser General Public. The boards provide digital and analogue input/output (I/O) pins that can be used to connect to expansion boards, breadboards (for prototyping), and other circuits. Serial communications interfaces, including Universal Serial Bus (USB) on some models, are available on the boards and are used to load programmes.

4.4 ATMEGA 2560

The Arduino Mega 2560 is an ATMEGA 2560-based microcontroller board. It contains 54 digital input/output pins, 16 analogue inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, USB connection, a power jack, an ICSP header, and a reset button. It comes with everything you'll need to get started with the microcontroller; simply plug it into a computer with a USB cable or power it with an AC-to-DC adapter or battery.

4.5 MOBILE CONTROL

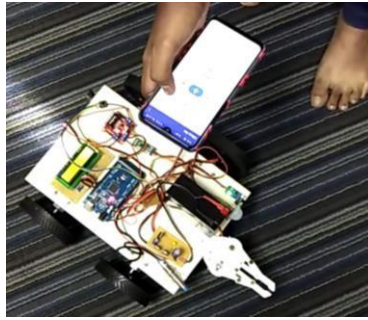


Fig 4.8. Mobile control

We have an app that allows the user to control the robot's movements in the direction they want it to go. The robot can move in full 360 degrees for complete surveillance, just as it used to be able to travel in standard directions.

4.6 METAL DETECTION

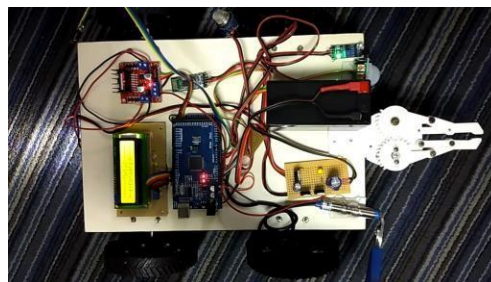


Fig 4.9. Metal detection

So, now that we've seen the project's mobility and how it was developed, let's move on to detection, the first of which is "Metal Detection." When a robot encounters something made of metal, the robot will be able to detect the object, which in this example is a grenade. The robot will obtain this information and transmit it to the server, as well as disable the explosive using the gripper positioned in the front.

4.7 FIRE DETECTION

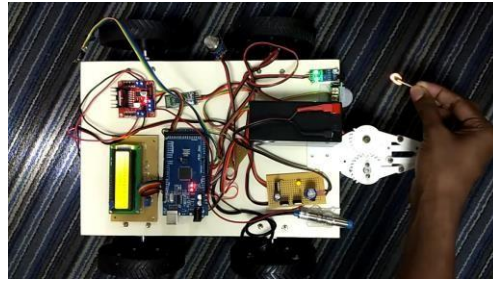


Fig 4.10. Fire detection

The next sensor is a fire sensor, which is used to detect explosives, explosions, or a specific amount of heat that is present in an area where it shouldn't be. The fire sensor will be able to capture event data and communicate it to the server, where it will be saved for future use.

4.8 GAS DETECTION

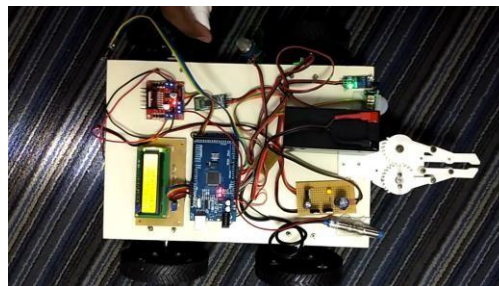


Fig 4.11. Gas detection

The "Gas Detection" step follows, and this is when the sensor gets more fascinating and vital, as it will be able to detect any type of gas that is changed in the atmosphere. And, as the other detections stated previously, it will be possible to save lives.

4.9 SELF-DESTRUCT MODE



Fig 4.12. Self-destruct mode

The "Self-Destruct" mode is the most important part of our project. As is clear, particularly the data contained on it, The self-destruction switch will be installed on the robot's side so that when it is pressed, data that has been collected for a long time will be destroyed and will never fall into the wrong hands again.

CHAPTER 5

RESULTS AND DISCUSSION

5.1 PROGRAM FOR LIFI SECTION

```
#include <LiquidCrystal.h>

#include <Servo.h>

LiquidCrystal lcd(13, 12, 11, 10, 9, 8);
#define ble Serial3
#define Li_Fi Serial2

#define splash splash1

#define m1 23
#define m2 25
#define m3 27
#define m4 29

#define gas A0
#define iR A1
#define PiR A2

#define key1 A3
#define key2 A4

#define MeT 2
Servo cutter;
String IncomingData = "";

int gas_r, pir_r, ir_r, met_r;
int k1_r, k2_r;
int li_c;
int self_destruct;

byte Alien[8] = {
  0b11111,
  0b10101,
  0b11111,
  0b11111,
  0b01110,
  0b01010,
  0b11011,
  0b00000};
```

```

byte Skull[8] = {
    0b00000,
    0b01110,
    0b10101,
    0b11011,
    0b01110,
    0b01110,
    0b00000,
    0b00000};

void setup()
{
    // initialize serial communications at 9600 bps:
    Serial.begin(9600);
    ble.begin(9600);
    Li_Fi.begin(9600);

    LcDSet();

    pinMode(m1, OUTPUT);
    pinMode(m2, OUTPUT);
    pinMode(m3, OUTPUT);
    pinMode(m4, OUTPUT);
    pinMode(16, OUTPUT);
    pinMode(gas, INPUT);
    pinMode(PiR, INPUT);
    pinMode(iR, INPUT);
    pinMode(MeT, INPUT);
    pinMode(key1, INPUT_PULLUP);
    pinMode(key2, INPUT_PULLUP);
    lcd.createChar(0, Alien);
    lcd.createChar(1, Skull);
    cutter.attach(3);
    cutter.write(120);
    analogWrite(9, LOW);
    stopbot();
    delay(2000);
    lcd.clear();
}

void LcDSet()
{
    lcd.begin(16, 2);
    splash(0, "Military");
    splash(1, "BoT");
    delay(2000);
    lcd.clear();
}

void loop()
{

```

```

k1_r = digitalRead(key1);
k2_r = digitalRead(key2);

if (self_destruct)
{
  lcd.write(byte(0));
  lcd.print(" ");
  delay(100);
  lcd.write(byte(1));
  lcd.print(" ");
  delay(100);
}
else
{
  getSensor();
  robo();
}

}

void getSensor()
{
  String out_ble = "";
  gas_r = analogRead(gas);
  ir_r = digitalRead(iR);
  pir_r = digitalRead(PiR);
  met_r = digitalRead(MeT);

  li_c += 1;
  if (li_c >= 2)
  {
    Li_Fi.print(gas_r);
    Li_Fi.print(",");
    Li_Fi.print(ir_r);
    Li_Fi.print(",");
    Li_Fi.print(pir_r);
    Li_Fi.print(",");
    Li_Fi.print(met_r);
    Li_Fi.println(",");
    li_c = 0;
  }
  else
  {
    Li_Fi.flush();
  }

  lcd.setCursor(0, 0);
  lcd.print("G   : ");
  lcd.setCursor(3, 0);

```

```

lcd.print(gas_r);

lcd.setCursor(8, 0);
lcd.print("F :      ");
lcd.setCursor(11, 0);
lcd.print(!ir_r);

lcd.setCursor(0, 1);
lcd.print("M   : ");
lcd.setCursor(3, 1);
lcd.print(met_r);

lcd.setCursor(8, 1);
lcd.print("H :      ");
lcd.setCursor(11, 1);
lcd.print(pir_r);

if (gas_r > 600)
{
    splash(0, "Toxic GaS");
    splash(1, "Detected");
    out_ble = "Toxic GaS Detected ";
    out_ble += "Gas Level ";
    out_ble += gas_r;
}
else
{
    out_ble = "Gas Level ";
    out_ble += gas_r;
    out_ble += ",";
}
if (!ir_r)
{
    splash(0, "Fire");
    splash(1, "Detected");
    out_ble += " Fire Detected,";
}
else
{
    out_ble += "";
}

if (pir_r)
{
    splash(0, "Motion");
    splash(1, "Detected");
    out_ble += " Motion Detected,";
}
else
{

```

```

    out_ble += "";
}
if (met_r)
{
    splash(0, "Metal");
    splash(1, "Detected");
    out_ble += " Metal Detected,";
}
else
{
    out_ble += "";
}

if (k1_r == 0 or k2_r == 0)
{
    self_destruct = 1;
    lcd.clear();
    lcd.setCursor(0, 0);
    splash(0, "Self");
    splash(1, "Destructed");
    out_ble = "Self Destruct Mode Activated...!!!";
    Li_Fi.end();
    lcd.setCursor(0, 0);
}
ble.print(out_ble);
ble.println(" ");

delay(500);
}
void robo()
{

while (ble.available())
{ //Check if there is an available byte to read

    delay(10);          //Delay added to make thing stable
    char c = ble.read(); //Conduct a serial read
    // Serial.println(c);
    if (c == '#')
    {
        break; //Exit the loop when the # is detected after the word
    }
    IncomingData += c; //Shorthand for IncomingData = IncomingData + c
}
if (IncomingData.length() > 0)
{
    Serial.println(IncomingData);

    if (IncomingData == "*forward")
    {

```

```

    forward();

    //    left();
}
else if (IncomingData == "*backward")
{

    backward();
    //    right();
}

//-----Turn On One-By-One -----//
else if (IncomingData == "*right")
{

    right();
    //    forward();
    // left();
}
else if (IncomingData == "*left")
{

    //right();
    left();
    //    backward();
}

else if (IncomingData == "*stop")
{

    stopbot();
}
else if (IncomingData == "*close")
{
    ble.println("close");
    cutter.write(120);
    analogWrite(9, LOW);
}
else if (IncomingData == "*open")
{
    ble.println("open");
    cutter.write(95);
    analogWrite(9, LOW);
}

IncomingData = "";
}
delay(10);
}

```

```

void forward()
{
  splash(1, "Forward");
  Serial.println("FORWARD" );
  ble.println("FORWARD" );
  digitalWrite(m1, HIGH); digitalWrite(m2, LOW);
  digitalWrite(m3, LOW); digitalWrite(m4, HIGH);
}

```

```

void backward()
{
  splash(1, "Backward");
  Serial.println("BACKWARD" );
  ble.println("BACKWARD" );
  digitalWrite(m1, LOW); digitalWrite(m2, HIGH);
  digitalWrite(m3, HIGH); digitalWrite(m4, LOW);
}

```

```

void right()
{
  splash(1, "Right");
  Serial.println("RIGHT" );
  ble.println("RIGHT" );
  digitalWrite(m1, HIGH); digitalWrite(m2, LOW);
  digitalWrite(m3, HIGH); digitalWrite(m4, LOW);
}

```

```

void left()
{
  splash(1, "Left");
  Serial.println("LEFT" );
  ble.println("LEFT" );
  digitalWrite(m1, LOW); digitalWrite(m2, HIGH);
  digitalWrite(m3, LOW); digitalWrite(m4, HIGH);
}

```

```

void stopbot()
{
  splash(1, "Stop");
  Serial.println("STOP" );
  ble.println("STOP" );
  digitalWrite(m1, LOW); digitalWrite(m2, LOW);
  digitalWrite(m3, LOW); digitalWrite(m4, LOW);
}

```

5.2 PROGRAM FOR LIFI RX

```
#include<LiquidCrystal.h>

#include <SoftwareSerial.h>

SoftwareSerial esp(3, 2);
LiquidCrystal lcd (13, 12, 11, 10, 9, 8);

#define splash splash1
#define Li_Fi_Rx Serial

int gas_r, pir_r, ir_r = 1, met_r;
String k;

String network = "Project";
String password = "1234567890";
#define IP "184.106.153.149"
String GET = "GET /update?api_key=LO2AQC6Y3LEEL5JQ";

//Militarybot123

int tu=40;
void setup() {
  // put your setup code here, to run once:
  esp.begin(115200);

  Serial.begin(9600);
  Li_Fi_Rx.begin(9600);
  LcdSet();
  setupEsp8266();
}

void LcdSet() {

  lcd.begin(16, 2);
  splash(0, "");
  splash(1, "");
  delay(2000);
  lcd.clear();

}

void loop() {
  // put your main code here, to run repeatedly:
  while (Li_Fi_Rx.available()) {

    char tem = Li_Fi_Rx.read();
```

```

    k += tem;
    delay(10);
}
if (k.length() > 4) {

    Serial.println(k);
    String gas = getSplitValue(k, ',', 0);
    String ir = getSplitValue(k, ',', 1);
    String pir = getSplitValue(k, ',', 2);
    String met = getSplitValue(k, ',', 3);
    gas_r = gas.toInt();
    ir_r = ir.toInt();
    pir_r = pir.toInt();
    met_r = met.toInt();
    k = "";

}

lcd.setCursor(0, 0);
lcd.print("G : ");
lcd.setCursor(3, 0);
lcd.print(gas_r);

lcd.setCursor(8, 0);
lcd.print("F : ");
lcd.setCursor(11, 0);
lcd.print(!ir_r);

lcd.setCursor(0, 1);
lcd.print("M : ");
lcd.setCursor(3, 1);
lcd.print(met_r);

lcd.setCursor(8, 1);
lcd.print("H : ");
lcd.setCursor(11, 1);
lcd.print(pir_r);

if (gas_r > 600)
{
    splash(0, "Toxic GaS");
    splash(1, "Detected");
}

if (!ir_r)
{
    splash(0, "Fire");
    splash(1, "Detected");
}

```

```

if (pir_r)
{
    splash(0, "Motion");
    splash(1, "Detected");
}

if (met_r)
{
    splash(0, "Metal");
    splash(1, "Detected");
}

tu++;
if(tu>50){
    splash(0, "Please Wait");
    splash(1, "Sending Data");
    updateServer(String(gas_r),String(lir_r),String(pir_r),String(met_r));

    delay(3000);
    lcd.clear();
    tu=0;
}
delay(100);
}

```

5.3 DATA GRAPH

As we have seen the working of our project, the variation of the data should be shown visually in which we have used the a certain software called the “Thinkspeak” – An IOT platform carrier which permits to collect, view and examine the ongoing data streams within the cloud. It does this by providing real-time visualizations of data that will be varying constantly sent to thinkspeak by your devices. The variation of the data can be seen by the means of graphical model, in which we can get accurate results of the changing variation of live data at anytime possible. The most important thing to be noted is that the data that has been gathered the whole can be stored for a long period of time, as long as thinkspeak can be accessed. The storage of the data can be used for the future use of the machine working in which we can be use to get the work done.

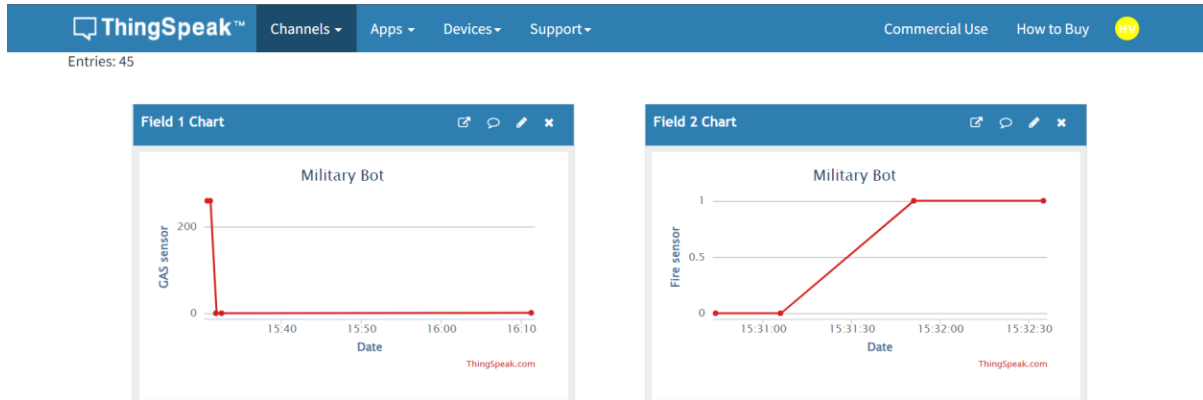


Fig 5.1. Data graph (a)

Now to the explanation of how the graph works. As the graph represents the data that has been variation of the results of the various sensor working, the sensor works as in binary function. In which the basic things are of the that is “1=ON & 0=OFF”, as every time the sensor detects “1” the variation of the data can be seen in the data graph and when the sensor doesn’t detect anything than obviously it will remain in the off state (0) and graph will be not showing any variation of the data.

Every sensor that has been embedded in the machine has unique works of detecting different types of sensing around it like gas, fire, motion & metal. So the variation of each sensor should be shown separately which will be clear explanation of how much of the variation that has been occurred in the sensing element. The data representation should be accurate because of the usage of the machine depends of how much of the sensing has been made in the project that should be done in the project.

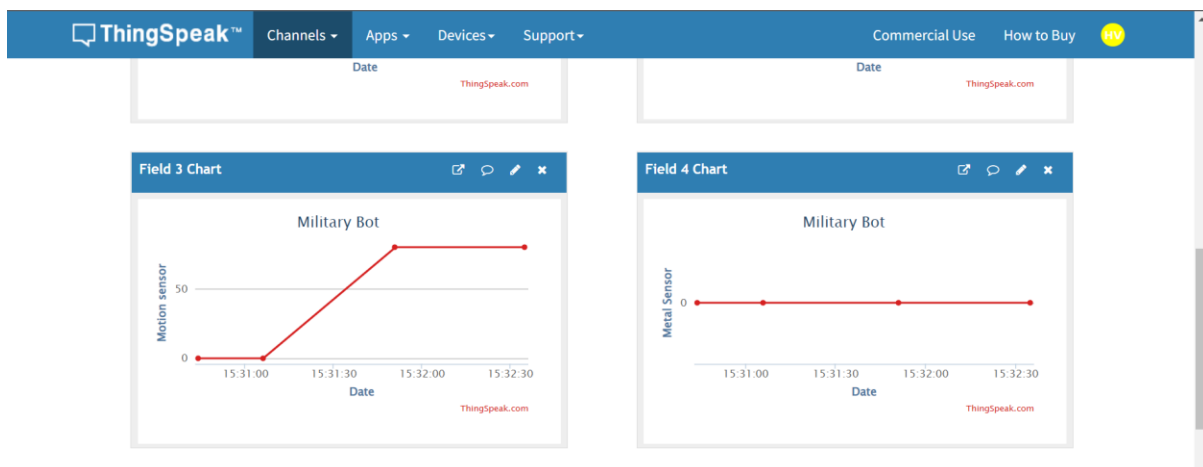


Fig.5.2 Data Graph (b)

As the data variation can be seen in the graph, the studying of it should be necessary as well. It's not complex and a simple procedure to be done. Every sensor in the device has its own graph chart as seen above, but works in similar way. The horizontal line that has been below the chart is time in which the time measured can be seen at any given point. The vertical line at the left side shows the measurement of the sensing level that will be sensed and shown the variation that occurred throughout the experiment. The red line is the data line in which the data that has been sensed will be visually vary in the graph to be shown at exactly the data has been varying at which time and what level can be seen. The whole of the data that has been varying will be a live update, which will be monitored constantly for the physical use of the device in this case surveillance of explosive of the data that has been shown. The data will be stored for a long time in which can be used for future use.

5.4 Discussion

Our project is used for the detection of explosives in the field for the safety of soldiers, in any manned or unmanned territory. The thing that makes it special or the novelty of the project is the usage of LI-FI, which is the VLC [Visible Light Communication] technique in which instead of using sound waves, we will be using light waves to send the data to store it. Because of it the data will be sent faster in which this is the first time, a technique like this is used in military surveillance. Our project is used to detect types of explosives in which, Metal detection for grenades, Fire detection for any fire harm, Gas detection for any toxic explosives and motion sensing for if to see anybody is before the robot. As it's a military tech, we have even made a self-destruction process in which if it gets to wrong hands, the data will be deleted in the robot. The data that is stored and changing process can be seen from other side constantly, in which it can be stored for future use to. The code of our robot is used by arduino, the controller app we created by using MIT app inventor and the software we used to see and store data is using Thing speak.

CHAPTER 6

CONCLUSION

Our project is currently at the experimental stage in the current field. Our idea is a simple one in which we employed a combination of LI-FI and Bluetooth, which is a unique feature, and we expect to see this become significantly more advanced in the future. The project is being utilized for military surveillance, but it might be used for other types of surveillance if it can be improved for years to come. The major goal of our technical expertise is to improve and protect the society around us so that future generations can benefit from it. Our project, we feel, is the type of project that will be a part of it.

REFERENCES

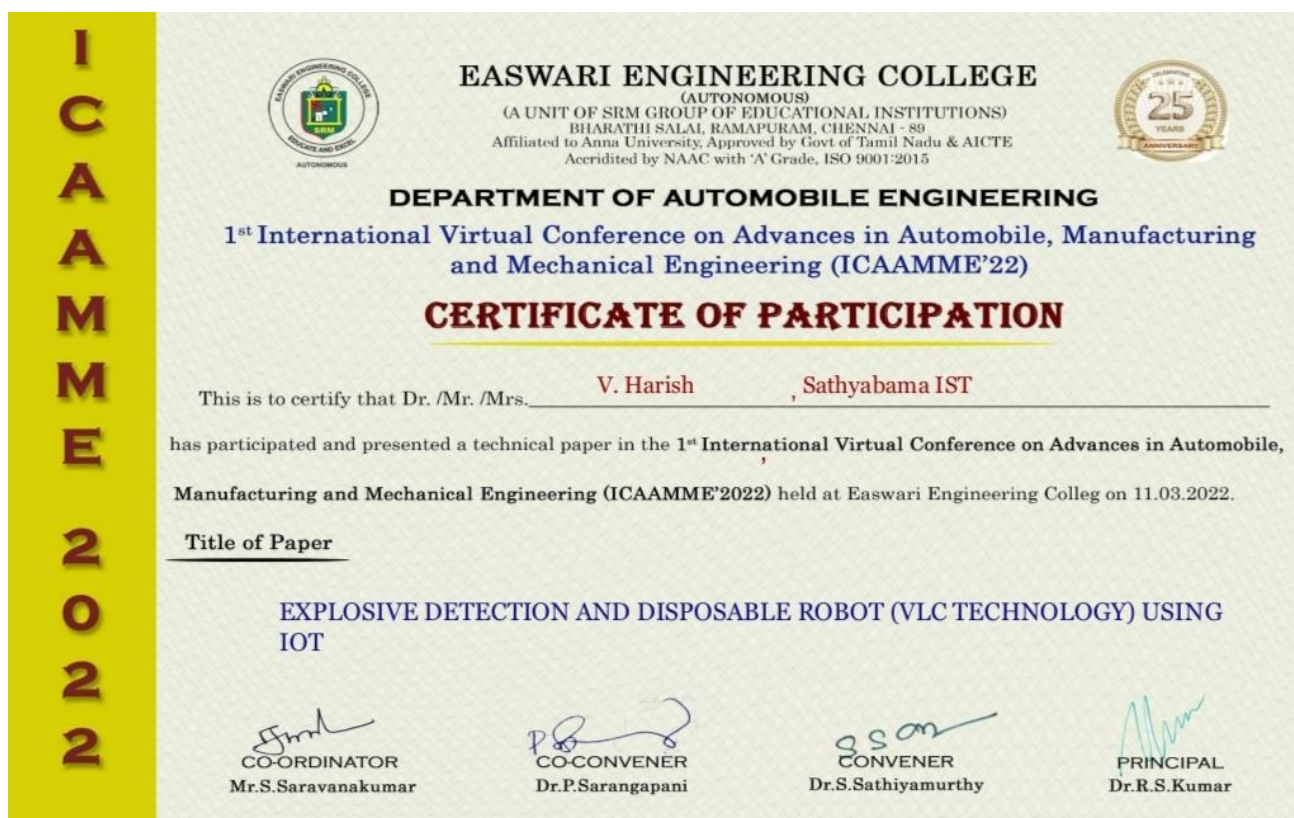
- [1] Akinde.O.K et al (2019), "Automated Bomb Detection system for composite terrorist disarmament (CTD), International journal of mechanical, electrical and computer technology (IJMEC), Vol:9, No:34, PP:4352-4364.
- [2] Ashokkumar.M et al (2018), "Intergrated IOT based design and android operated multi-purpose field surveillance robot for military use", Journal of advance in engineering research, Vol:142, PP:236-243.
- [3] Chaitrali Jadhav et al (2018), "Military spying and bomb disposal robot using IOT", International Research journal of engineering and technology, Vol:5, Issue:4, ISSN-2395-0072.
- [4] Charisma.S et al (2018), "Metal and gas detecting robot using IOT", International journal of scientific research and review, Vol:7, Issue-4, ISSN: 2379-543X.
- [5] Devendra.R.Bodkhe et al (2017), "IOT Robot: with bomb diffusing application", International research journal of engineering and technology, Vol:3, Issue:12, ISSN-2395-0072
- [6] Dinesh Tharun.S et al (2020), "Metal Detection by drone for surveillance using actuators", Journal of critical reviews, Vol:7, issue-4, ISSN-2394-5125.
- [7] Ferreira et al (2015), "Visible light communications (VLC) Technology", DOI: 10.1002/047134608X.W8267
- [8] Keerthana.S et al (2019), "Bomb detection and disposal robot: aid for risky military fields", International journal of engineering and advanced technology (IJEAT), Vol:8, Issue-6, ISSN-2249-8958.
- [9] Nandgopal Rathod et al (2020), "Advanced spying and bomb disposal robot", International journal of scientific & Engineering research, Vol:11, Issue – 6, ISSN – 2229-5518.
- [10] Narendra Prasad (2017), "IOT controlled metal detecting robot with remote video transmission to assist bomb detection and rescue team using RPI", International journal of technological research in engineering, Vol:4, Issue-11, ISSN-2347-4718.
- [11] Nikhil.C.Y et al (2018), "IOT Based armed surveillance vehicle", International journal of advanced research in science and engineering, Vol:7, Issue:7, ISSN-2319-8354.

- [12] Pankaj Agarwal et al (2019), "Unmanned bomb disposal robot using IOT", International journal of scientific research & development, Vol:7, Issue-2, ISSN-2321-0613.
- [13] Parameshwari.V et al (2021), "An intelligent Bionic Person for Bomb Detection and diffusion using Internet of Things (IOT) in Military application, International Journal of Mechanical Engineering, Vol:6, No:3 ISSN – 0974-5823.
- [14] Prakash.N et al (2021),"Multipurpose military surveillance robot", International journal of scientific research & development, Vol:9, Issue:4, ISSN – 2321-0613.
- [15] Rushikesh Uphad et al (2019), "A secure bomb diffusal spy robot controlled using Android APP", International journal of computer science and mobile computing, Vol:8, Issue – 6, PP:1-6.
- [16] Sarmad Hameed et al (2019), "Military spying robot", International journal of innovative technology and exploring engineering, Vol:8, Issue: 7, ISSN-2278-3075.
- [17] Saurabh Mahawadiwar et al (2018), "Bomb disposal robot using arduino", International journal of advanced research in computer and communication engineering, Vol:7, Issue-7, ISSN-2278-1021.
- [18] Shekar Goud.D et al (2017), Raspberry Pi based bomb detection robot with live streaming and tracking controlled with internet", International journal & magazine of engineering technology, management and research, Vol:4, Issue:2, ISSN-2348-4845.
- [19] Yuvaraju.M et al (2017), "Autonomous defense robot in metal detecting and chemical sensing using internet of things, International journal of advanced in electrical, electronics and instrumentation engineering, Vol:6, Issue:6, ISSN: 2320-3765.

OUTCOME OF THE PROJECT

- We had applied and attended a conference at 1st International Virtual Conference on Advances in Automobile, Manufacturing and Mechanical Engineering (ICAAMME'22) – Easwari Engineering College.
- Submitted as Journal Paper to ICAAMME'22
- Proceedings – Materials Today.

Conference Proceedings of ICAAMME'22 certificate:





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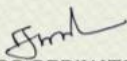
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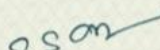
has participated and presented a technical paper in the 1st International Virtual Conference on Advances in Automobile, Manufacturing and Mechanical Engineering (ICAAMME'2022) held at Easwari Engineering Colleg on 11.03.2022.

Title of Paper

EXPLOSIVE DETECTION AND DISPOSABLE ROBOT (VLC TECHNOLOGY) USING IOT


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PRINCIPAL
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<ICAAMME'22_prasad>

[Materials Today]

Explosive detection and disposable robot (vlc technology) using iot

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Abstract

The major goal of building this robot is to monitor human activity in combat zones or border regions to limit enemy infiltration. Military personnel faces a significant danger of death when approaching uncharted territory. The robot will be an appropriate machine for the defense sector, reducing human life loss and preventing criminal operations. There will assist all military personnel and armed forces in understanding the state of the land before entering it. This robot consists of a Gas sensor to detect toxic gases, a fire sensor to detect if there is any presence of fire in the robot's path, a motion detection sensor to detect if there's any enemy presence in the way of the robot, a metal detector sensor to detect the landmines, all the sensor's parameters will be transmitted from the robot using VLC technology which is a novelty of this project. In this vehicle, the signals transmitted from the user's device are used for vehicle motion, this information is sent back to the user's device via a wireless system.

Keywords: Microcontroller; Li-Fi; DC motor; Bluetooth Module; Android

1. Introduction

Our concept is based on the current state of civil wars, military instability, and terrorist scenarios around the world. Almost every day, a large number of trained personnel are hurt or killed when dealing with or attempting to disarm bombs. The limitless number of news items and films that surface every day on news channels and print media around the world can attest to all of this. Even though our project's concept is unique, other projects have comparable goals. The French police, for example, have a bomb disposal robot, as does the Israeli army, and it is also in use by bomb squads in some US states. The robot's main purpose is to assist the bomb disposal squad in ensuring their safety and security from the hazards they face regularly. Although India's bomb squads have metal detectors and maybe other technology for detecting and disposing of bombs, they must nevertheless put their lives in danger by physically approaching the device or suspicious packs without any safety or precautions. Our robot will provide an extra layer of safety for bomb squad members by allowing them to quickly verify and analyze any suspicious package, and if one is found, the robot can be commanded to defuse it as well. In most cases, a mobile robot minimizes or eliminates the need for human intervention.

2. Existing system and proposed system

Existing system

In the current system, the majority of which are used in bigger airports. When in fields as army persons or entities, they must face several dangers to their lives while spying on the enemy or opposing entities. A robot will be more fit for this duty to overcome these notions, reducing the risk of human lives being lost and allowing them to better spy on their adversaries' unlawful maneuvers.

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