DETECTING THE LANDMINE'S BY DEFENCE ROBOT

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ABSTRACT

In Modern world, Automation robot is used in many of the fields such as defense, surveillance, medical field, industries and so on. In this paper, the robot system can safely handle bombs especially while catching them and avoids the danger of explosion or extra pressure on suspected object. It is equipped with a soft catching gripper for pick and place function. The remote operation is achieved by a Bluetooth modem via an Android phone based GUI application. This pick and place robot uses two motor driver ICs to control two sets of motors.

One set of motors is used to control the vehicle's movement and the other set to operate the soft catching gripper, and this can be done by pressing the corresponding buttons on an Android application. After picking the object, the soft gripper holds the object and places it to another place by adjusting the vehicle movement. The microcontroller's program manages the overall control operation, and the program can be modified by the user based on the requirement. Based on the signals from the Bluetooth, the microcontroller sends command signals to the motor driver ICs. In this system, there is a possibility to add a wireless camera for monitoring overall process.

Keywords: Robot mechanism, metal detector, Arduino microcontroller.

INTRODUCTION
General Background

The purpose of development of science and technology in any country aims at improving standards of living of people in the country. People will lead life happily if there are enough resources and security for them. Now-a-days, technology is going in to hands of negative minded people and they use of it for destruction.

The more legal security is developed the more illegal activities are being increased. These negative minded people always aims at killing large population by small means of weapons. They find it easy to take away the lives of lots of people mainly aiming at public places by means of a well-known destructive weapon which we commonly call it as **BOMB**.

Description

Introducing android application to control and monitor the detection and diffusion process makes the detection and diffusion very easy to perform. Arduino, a student level microcontroller board which is easy to program by having a basic knowledge in C- language is used. We are aimed at providing a prototype kit which have

capabilities to detect and diffuse the bomb and makes it possible for security departments to protect human lives easily.

Objectives

The main objectives of this project are:

Using of RF communication to enable long range operation of kit. Providing both detection and diffusion capabilities by installing a metal detector and bomb cutting equipment which are suitable to dismantle any advanced destructing equipment's. Wireless camera surveillance which improves the decision making capabilities of the respected authorities. A prototype system with an Arduino microcontroller which can be later modified by including IoT and machine learning concepts to completely automate the process.

Scope of the Project

This project as a prototype uses Bluetooth Communication for controlling the movement of robot, but it can be extended to long range by using Wi-Fi and Microwave frequencies. As the robot is capable of both detection and diffusion, it can be used for all moderate applications of military and police. It can be extended up to complex applications by using machine learning and artificial intelligence This is a low cost solution to solve two major problems bomb detection and bomb diffusion. Further increase in the investment of project can provide strong robots which can withstand any worse conditions and operate in a very highly efficient way.

Circuit Diagram

The circuit diagram shows various components and functional blocks used in the project, a detailed explanation of each block and component is given in further chapters.
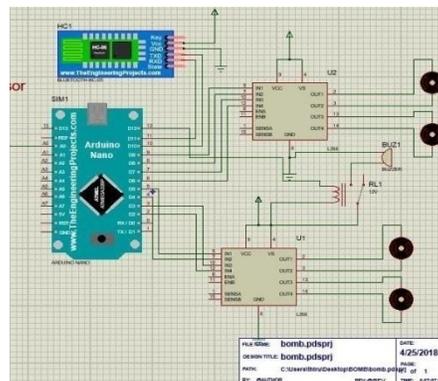
Circuit Diagram

Working in brief

A four wheeled small robotic vehicle carries the metal detector module and it moves with the help of dc motors which are controlled by the instructions given by controller using an android application. It has controls to move the device left, right, straight and backwards to make it easy to search the explosive material. The robot chassis consists of an Arduino Microcontroller which was interfaced with Bluetooth module. The Bluetooth module gets information from the controlling person using low range Radio Frequency Waves.

After getting known that the bomb is found an alarm starts begin to ring to alert the environment around it. Then by using special controls form the

android application we will activate the motors in robotic arm which is used to diffuse the bomb.

LITERATURE REVIEW

Maki .K. Habib and Yuan Baudoin [1] published a paper on **Robot-Assisted Risky Intervention, Search, Rescue and Environmental Surveillance.** In this paper they categorized the source of disasters and associated missions and highlights the needs for suitable and reliable technology and technical and functional requirements of robotic systems to full - fill task objectives. Zeng- Jian Jun, Yang- Ru- Qing, Zhang- Wei Jun [2] presented about **Research on Semi- Automatic Bomb Fetching for a Robot.** An EOD robot system, SUPER- PLUS, which has a novel semi- automatic bomb fetching function is presented in this paper**.** Julie Carpenter (University of Washington, USA) [3] presented on **Exploring the Impact of Humanoid Robot Integration into Explosive Ordnance Disposal Teams,** which provides a critical analysis of the potential short- and long-term cultural, emotional, and ethical outcomes facing Explosive Ordnance Disposal (EOD) specialists working closely with anthropomorphic robots in daily team situations as viewed through the interdisciplinary lens of Human-Robot Interaction (HRI) research. P. Raja and S. Pugazhenthi, School of Mechanical Engineering, SASTRA University, Thanjavur [4] wrote a book on **optimal path planning of mobile robots,** which says about applications of mobile robots in planet exploration, surveillance, landmine detection, etc. This article provides an overview of the research progress in path planning of a mobile robot for off-line as well as on-line environments. James Trevelyan, William R. Hamel, Sung- Chul Kang [5] wrote a book on **Robotics in Hazardous Applications,** with the vision of disaster response: search and rescue robots carrying people from burning buildings or tunneling through collapsed rock falls to reach trapped miners.

METHODOLOGY

Robotic Vehicles and Grippers

Robotics is the study of robots and robots are electro-mechanical machines that are used to perform different tasks. Most popular robots are placed in hazardous places because these robots perform the tasks that humans are restricted to perform**.** Some robots can do work by themselves and other robots always need the help of persons to perform the tasks or to tell the task to be done. Robots can be used in different fields like medical, space communication, military applications, and soon. Manipulation robotic system is classified into three types:

1. Autonomous controlled robots

2. Remote controlled robots

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3. Manually controlled robots

Types of Autonomous Robotic System

Out of three types of manipulation robotic system, the autonomous system is further classified into four types:

> Programmable
> Non-programmable
> Adaptive
> Intelligent

Programmable Automatic Robot

A programmable robot is a first generation robot with an actuator facility on each joint. The robots can be reprogrammable based on the kind of application they are commissioned to. The function and application of the robots can be changed by reprogramming after the robot is programmed once to perform a function in the given pattern and fixed sequence.

Figure Programmable Automatic Robot

Non-Programmable Automatic Robot

This robot is one of the basic types of robot, in fact, a non-programmable robot. This robot is not even considered as a robot, but is an exploiter lacking reprogrammable controlling device. The mechanical arms used in industries are some of the examples of these types of robots wherein the robots are generally attached to the programmable devices used in industries for mass production as shown in the figure.

Figure Non- Programmable Automatic Robot

Adaptive Robot

Adaptive robots are also industrial robots that can be adapted independently to various ranges in the process. However, these robots are more sophisticated than programmable robots. These can be adapted up to a certain extent, and after evaluation they can perform the action required in that adapted area. These robots are mostly equipped with sensors and control systems.

Figure Adaptive Robot

Grippers:

Robot grippers are the physical interface between a robot arm and the work piece. There are four types of robotic grippers: vacuum grippers, pneumatic grippers, hydraulic grippers and servo-electric grippers.
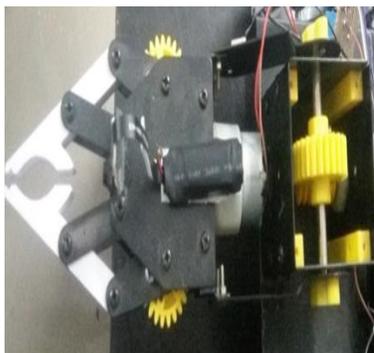

Fig: Gripper of Robot

Applications of RF Communication

RF communication mainly used for wireless data, voice transfer applications, and home automation applications, remote control applications and in industry oriented applications.

ARDUINO NANO

Introduction:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs – light on a sensor, a finger on a button, or a Twitter message – and turn it into an output – activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language and the Arduino Software (IDE), based on Processing. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers – students, hobbyists, artists, programmers, and professionals – has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software,

too, is open-source, and it is growing through the contributions of users worldwide.

Thanks to its simple and accessible user experience, Arduino has been used in thousands of different projects and applications. The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. Teachers and students use it to build low cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, Musicians and artists use it for installations and to experiment with new musical instruments. Makers, of course, use it to build many of the projects exhibited at the Maker Faire, for example. Arduino is a key tool to learn new things. Anyone – children, hobbyists, artists, programmers – can start tinkering just following the step by step instructions of a kit, or sharing ideas online with other members of the Arduino community.

There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Net media's BX-24, Phi d gets, MIT's Handy board, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

Arduino Nano Tutorial – Pin out & Schematics

Arduino Nano Pin out:

The Arduino Nano, as the name suggests is a compact, complete and bread-board friendly microcontroller board. The Nano board weighs around 7 grams with dimensions of4.5 cms to 1.8 cms (L to B). This article discusses about the technical specs most importantly the pin out and functions of each and every pin in the Arduino Nano board. Arduino Nano has similar functionalities as Arduino Due milanove but with a different package. The Nano is inbuilt with the Atmega328P microcontroller, same as the Arduino UNO. The main difference between them is that the UNO board is presented in PDIP (Plastic Dual-In-line Package) form with 30 pins and Nano is available in TQFP (plastic quad flat pack) with 32 pins. The extra 2 pins of Arduino Nano serve for the ADC functionalities, while UNO has 6 ADC ports but Nano has 8 ADC ports. The Nano board doesn't have a DC power jack as other Arduino boards, but instead has a mini-USB port. This port is used for both programming and serial monitoring. The fascinating feature in Nano is that it will choose the strongest power source with its potential difference, and the power source

selecting jumper is invalid.

Arduino Nano – Specification

Figure Arduino Nano Pin Descriptions

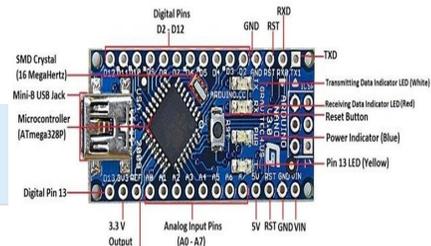| Arduino Nano	Specifications
Microcontroller	Atmega328P
Architecture	AVR
Operating Voltage	5 Volts
Flash Memory	32 KB of which 2 KB used by Boot loader
SRAM	2KB
Clock Speed	16 MHz
Analog I/O Pins	8
EEPROM	1 KB
DC Current per I/O Pins	40 milli Amps

Table Specifications if Arduino nano

Figure Arduino Nano Outlook

Applications

We have compiled a huge list of Arduino Nano based projects with complete source code and detailed explanation of the circuits.

➢ Simple Robotics ARM Project Using Arduino.

➢ Auto Intensity Control of Street Light Using Arduino.

➢ Measuring Wheel/Surveyor's Wheel Using Arduino Nano & Rotary Encoder.

➢ Gesture Controlled Mouse (Air Mouse) Using Arduino Nano &Accelerometer.

➢ DC Motor Speed Control using Arduino &PWM.

LAND MINE

Introduction

A land mine is an explosive device concealed under or on the ground and designed to destroy or disable enemy targets, ranging from combatants to vehicles and tanks, as they pass over or near it. Such a device is typically detonated automatically by way of pressure when a target steps on it or drives over it, although other detonation mechanisms are also sometimes used. A land mine may cause damage by direct blast effect, by
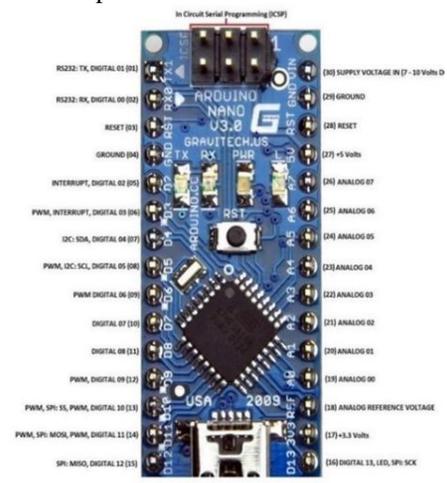
fragments that are thrown by the blast, or by both. The name originates from the ancient practice of military mining, where tunnels were dug under enemy fortifications or troop formations. These killing tunnels ("mines") were at first collapsed to destroy targets located above, but they were later filled with explosives and detonated in order to cause even greater devastation.
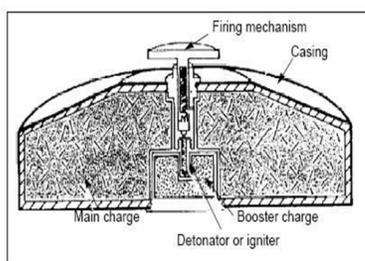

Figure Landmine components

MAJOR COMPONENTS

Metal Detection

A metal detector is an electronic device, which are used by millions of people across the globe to detect nearby metal. The devices work via the science of electromagnetism and are made up of various shapes and sizes and used for a number of different purposes.

Metal detectors are also a prominent feature at airports and used at large sporting events for security. They are used by our military and security services to help uncover.

Figure Metal Detector

RESULT

The kit is working according to the pre- planned design and it is tested to detect a metal object by controlling it with Android Application remotely. The code was running successfully without any errors and implementing the idea properly. We have connected the robot to the mobile using the GSM module with the pre- defines password of "1234" and thereby passed instructions to it, to move to various directions in order to trace the bomb.

Finally, it found the object using the metal detector circuit and started buzzing the loud speaker. By special commands from the application, the bomb was dismantled properly using the wireless camera to take decisions quickly and accurately. We are satisfied with the operation of the robot qualitatively, for its good operation in small distance ranges. We are planning to extend it long distances and bring advancement in it by including IoT in to the project. The following figures shows the operation of the robot which is tested
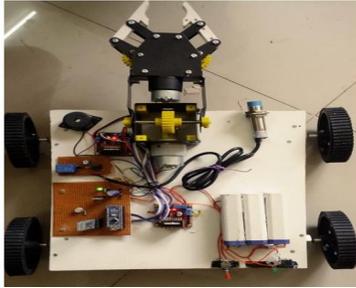
after finishing it.

Figure Working Model

CONCLUSION

Overall, an autonomous robot with a wire cutter that perform diffusion operation has been successfully built. The robot has been able to detect and diffuse bombs effectively. The robot been made is a working prototype of the bomb detection and diffusion robot vehicle. By using Arduino microcontroller, the robot have performed it task perfectly according to the program that being made. Further developments like, introducing usage of other connections like GPS will be advantageous in the respect of location.

The system is going to handle hazardous material with greater mobility. In today's life at many industrial sectors workers works with very dangerous and harmful machines, parts and chemicals. That's why people lose their lives or may get injured. So our project gives them a safety for handling those hazardous materials in industries and military application. This Robot has been designed in such a way that it can cater to the needs of the bomb disposal squad, the military, the police and also for the Personnel who handle radioactive materials. It has countless applications and can be used in different environments and scenarios. For instance, at one place it can be used by the bomb disposal squad, while at another instance it can be used for handling mines. While another application can be to provide up to date information in a hostage situation.

FUTURE SCOPE

1. Step climbing mechanism: - Step climbing mechanism is used for using the staircase which will help the user to move from one floor to other floor

2. Wireless video transmission: - Wireless video transmission is used to keep the user away from the bomb site and control it from a safe distance.

3. Vision sensing technique: - The camera is mounted above the Robot and is able to pan and tilt. Its image is displayed on a screen so that users can select a feature with a pointing device.

4. Removable Gripper/Multi-Gripper Robotic Arm: - The gripper attached to the robotic arm is fixed at the moment that is, it will only work with the specific shaped of objects. Placing a gripper that can be removed and replaced by another gripper can solve this problem or a multi gripper robotic arm can be developed with more than 2 types of grippers for different type of materials and for different shaped of the objects.

5. Artificial Intelligence At present the robot does not have the capability to

make decisions on its own that is there is no built in artificial intelligence in it. Therefore the robots working are based purely on the decisions made by the end user of the robotic control application. Therefore Artificial Intelligence may be provided to the robot for making the process of decision-making much quicker and reliable

6. Night Vision Camera. For night mode or places where light is low a night vision camera can be mounted on the robot instead of a standard camera, which will increase the visibility in case of no light at all.

REFERENCES

[1] Maki .K. Habib and Yuan Baudoin published a paper on **Robot-Assisted Risky Intervention, Search, Rescue and Environmental Surveillance.**

[2] Zeng- Jian Jun, Yang- Ru-Qing, Zhang- Wei Jun presented about **Research on Semi-Automatic Bomb Fetching for a Robot.**

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[5] James Trevelyan, William R. Hamel, Sung- Chul Kang wrote a book on **Robotics in Hazardous Applications**

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