CUTTER MECHANISM BOMB DIFFUSER ROBOT

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Abstract- A time bomb (or a time bomb, time-bomb) is a bomb whose detonation is triggered by a timer. The use (or attempted use) of time bombs has been for various purposes including, terrorism, assassination and warfare. The explosive charge is the main component of any bomb, and makes up most of the size and weight of it. It is the damaging element of the bomb (along with any fragments or shrapnel the deflagration might produce with its container or neighboring objects). The explosive charge is detonated by a detonator. Mostly is terrorist attacks includes planting a time bomb at public places & in war field too this types of bombs are plant after leaving the hiding places. This proves to be very harmful when bomb diffusers fail to diffuse it. In order to reduce this risk we can make use of simple robots rather than going for complicated robots & strategies. As we know there is always presence of bomb diffusers in army, they take this risk at the cost of their life instead of that we can reduce this risk by robot. Some robots also designed where we are totally depended on them but here there also chances of having errors & confusing conditions for robots. Humans can take better decision than robots in critical conditions. So, in order to minimize chances of getting and error the design of robot must me simple with simple devices & their functioning. The robot mentioned is this paper is most simple one while the decision needed for diffusing bomb is given by bomb disposal experts sitting away from Robot & bomb as well. This reduces all the risks in war field and as well in terrorist attacks.

Keywords- Mechanism, Robot, Damaging Element, Diffuse Bombs etc.

I. INTRODUCTION

When we consider military robots today, there has been a huge development as compare to those robots used in earlier times. Today, military ground robots & unmanned vehicles are used worldwide. However, the significant growth of the current military robots comes as the nature of combat changes in every region while the globally integrated enterprise replaces nationalistic dominance. It can be said that military robot automation of the defense process is the next wave of military evolution.

The present military robots are automating military ground systems. These robots permit vital protection of soldiers and people in the field thus making the possibility of minimized fatalities. Today's mobile operates independently of the operator. BAE System has a very small size robot which is use for reconnaissance and networking robots in development. Today's military robots have great advantages. The use of remote-control toys in Iraq started as spontaneous robots to check out possible roadside bombs.

Time Bomb Image

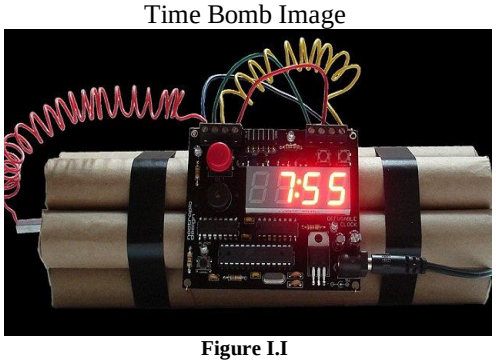


Figure I.I

Military robots today employed with the integrated system, including video screens, sensors, gripper and cameras. There are also military robots that are equipped with the weapon that can detect and protect themselves from any dangerous obstacles. Military robots have variety of shapes depending on the purpose of each robot. One of the most common military robots is the car robot. For a witness job, it is a little car or may be generally tanks that can be the target location. One of the other military robots which are often used by the military organization is the airplane robot.

Military robots today save lives. Defense security systems have an emphasis on causality reduction during combat. This has resulted in investment in robotics technology that is useful. Robotic research is on the fast track for government spending today.

Bomb holding robot not provided with cutter mechanism.

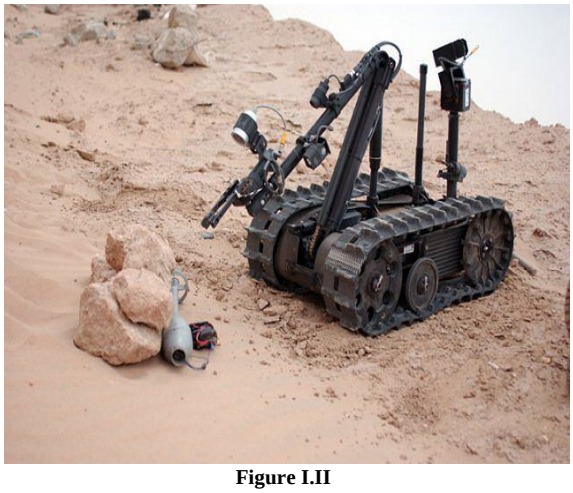


Figure I.II

II. HOW TO DIFFUSE A BOMB?

The experts cut the wire which open the circuit the circuits, in order to deactivate. A time bomb is a bomb whose detonation is triggered by a timer. A detonator is a device used to trigger an explosive device. The circuit of bomb with battery is connected to timer circuit. If any how we succeed to open the circuit than that bomb get deactivated but today due to advance technology the complicated circuits are made by terrorist. This increases complications for bomb diffusing experts to diffuse bomb at the cost of their life.

Time Bomb Circuit

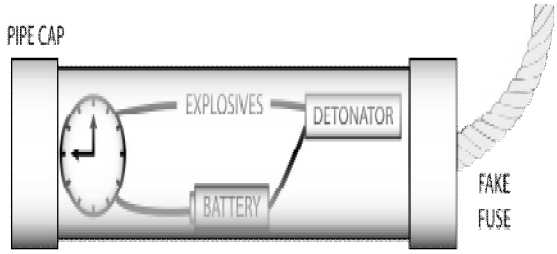


Figure II.I

The bomb diffusers use wire cutter to cut the wire, while the selection of wire depends upon expert thinking & type of circuit. In this project we are using a armed robot with vision to cut that wire.

III. WORKING CONDITIONS

Bomb disposal officers work in a variety of environments. The job can be within a combat zone or in the presence of civilians as the unit is responsible for defusing and dealing with explosive devices in all walks of life. During times of battle, bomb disposal officers will work on battle grounds and within combat towns, locating explosives and defusing them, or responding to bomb scares. When not in warzones, bomb disposal officers may work responding to civilian calls concerning threats of explosive devices or can be in training to improve their skills set.

Bomb disposal officers mostly work outside in a highly dangerous environment. Their job is one of the highest risk jobs with a mortality rate disproportionately higher than most other careers. As the most highly specialized in their field, bomb disposal officers are armed with the most exceptional level of skill but occasionally casualties and fatalities occur in the line of work, as defusing explosives can be difficult and unpredictable.

The equipment used in defusing bombs is highly technical and requires bomb disposal officers to be technically minded. Bomb disposal robots are sometimes used but in other cases officers will disarm bombs and explosive ordinance themselves. Communication technology and other high tech equipment is provided by the military for officers to complete their job in the safest way possible.

The hours for bomb disposal officers not in war zones are usually normal office hours, in regards to training and base camp activities. Bomb scares can, however, occur at any time so officers are always 'on call' in case there is a threat that needs their attention. During combat, officers will work in rotation but can be called to action at any time. Uniform is supplied for all soldiers in the military, including bomb disposal officers, and safety precaution clothing and equipment is provided.

IV. ROBOT DESIGN

The robot consists of mechanical system & electronics system.

1) Mechanical system contains:-
   a) Motors
   b) Frame Design
2. Electronic system contains:-
   a) RF-Module
   b) Wireless Camera

1) MECHANICAL SYSTEM

The system contains motors & frame. Motors are used to have mobility in robot & frame gives a rigid support to fix the motors and carry out the working provided to wire cutter through mechanism.

A. MOTORS

The motors used for moving the robot having is 160RPM 12V DC geared motors for robotics applications. It gives a massive torque of 30Kgcm. The motor comes with metal gearbox and centered shaft. Shaft has a metal bushing for wear resistance. This high torque capacity helps to carry additional load if required.

Features

- 160RPM 12V DC motors with Metal Gearbox
- 9000RPM base motor
- 8mm shaft diameter
- Gearbox diameter 40 mm.
- Motor Diameter 40 mm
- Length 97 mm without shaft
- Shaft length 18mm
- 300gm weight
- 30kgcm torque
- No-load current = 500 mA(Max), Load current = upto 3 A(Max)

Simple Dc Motor



Square Geared Motor

Figure IV.1.A.1

The motors used for cutter actuation & positioning is 10RPM 12V DC Geared motors for robotics applications. Very easy to use and available in standard size. Nut and threads on shaft to easily connect and internal threaded shaft for easily connecting it to wheel.

Features

- 10RPM 12V DC motors with Gearbox
- 6mm shaft diameter with internal hole
- 125gm weight
- Same size motor available in various rpm
- 5kgcm torque
- No-load current = 60 mA(Max), Load current = 300 mA(Max)

Motors connected in parallel



IV.1.A.2

B. FRAME DESIGN

A rigid frame in structural engineering is the load-resisting skeleton constructed with straight or curved members interconnected by mostly rigid connections which resist movements induced at the joints of members. Its member can take bending moment, shear and axial loads.

NOTE:-Because of complicated & compact design some projections are erased.

Diagram shows the Front view of robot

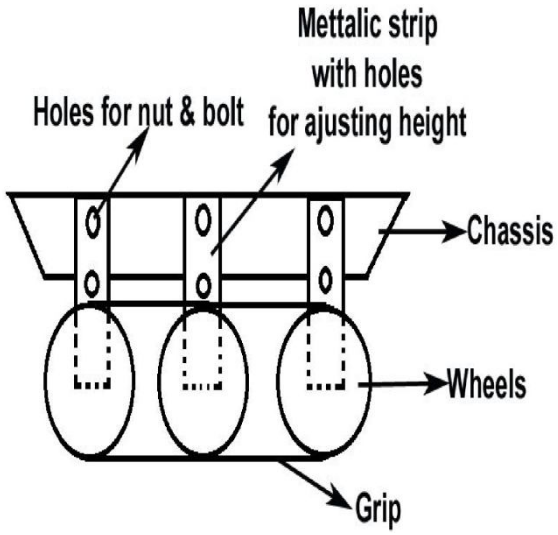


Figure IV.1.B.1

Figure shows top view of robot

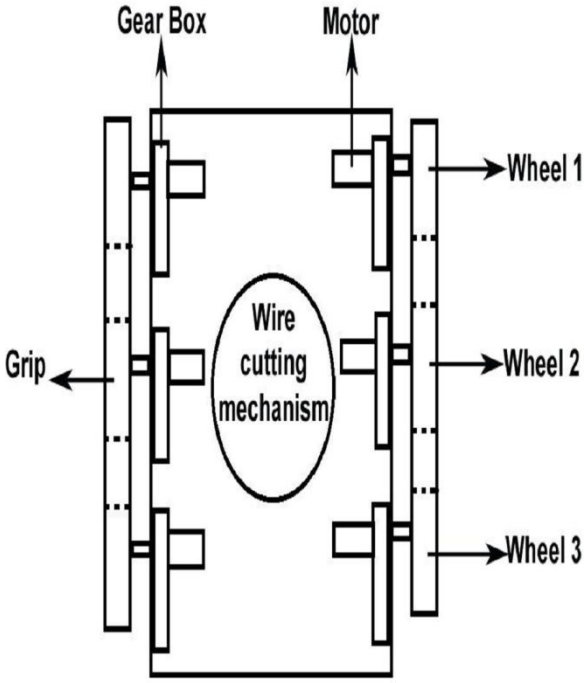


Figure IV.1.B.2

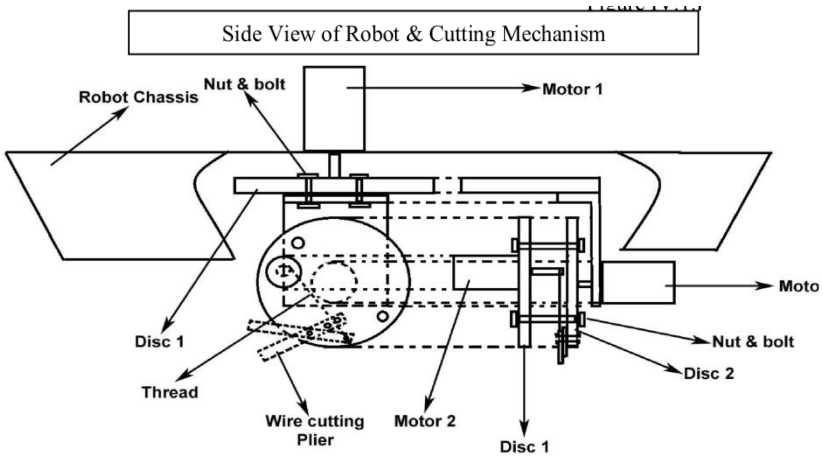


Figure IV.1.B.3

2) ELECTRONIC SYSTEM

Electronic systems are grouping of electronic circuits & components which are designed to accomplish one or more complex functions.

A. RF-MODULE

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources.

This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz's An RF transmitter Receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder. HT12E-HT12D, HT640-HT648, etc. are some commonly used encoder/decoder pair ICs.

i. HOW DOES RF-TRANSMITTER WORKS?

A radio transmitter is an electronic circuit which transforms electric power from a battery or electrical mains into a radio frequency alternating current, which reverses direction millions to billions of times per second. The energy in such a rapidly reversing current can radiate off a conductor (the antenna) as electromagnetic waves (radio waves). The transmitter also impresses information, such as an audio or video signal, onto the radio frequency current to be carried by the radio waves. When they strike the antenna of a radio, the waves excite similar (but less powerful) radio frequency currents in it. The radio receiver extracts the information from the received waves. A practical radio transmitter usually consists of these parts:

- A power supply circuit to transform the input electrical power to the higher voltages needed to produce the required power output.
- An electronic oscillator circuit to generate the radio frequency signal. This usually generates a sine wave of constant amplitude often called the carrier wave, because it serves to "carry" the information through space. In most modern transmitters this is a crystal oscillator in which the frequency is precisely controlled by the vibrations of a quartz crystal.
- A modulator circuit to add the information to be transmitted to the carrier wave produced by the oscillator. This is done by varying some aspect of the carrier wave. The information is provided to the transmitter either in the form of an audio signal, which represents sound, a video signal, or for data in the form of a binary digital signal.
  - In an AM (amplitude modulation) transmitter the amplitude (strength) of the carrier wave is varied in proportion to the modulation signal.
  - In an FM (frequency modulation) transmitter the frequency of the carrier is varied by the modulation signal.
  - In an FSK (frequency-shift keying) transmitter, which transmits digital data, the frequency of the carrier is shifted between two frequencies which represent the two binary digits, 0 and 1.

  Many other types of modulation are also used. In large transmitters the oscillator and modulator together are often referred to as the exciter.
  - An RF power amplifier to increase the power of the signal, to increase the range of the radio waves.
- An impedance matching (antenna tuner) circuit to match the impedance of the transmitter to the impedance of the antenna (or the transmission line to the antenna), to transfer power efficiently to the antenna. If these impedances are not equal, it causes a condition called standing waves, in which the power is reflected back from the antenna toward the transmitter, wasting power and sometimes overheating the transmitter. In higher frequency transmitters, in the UHF and microwave range, oscillators that operate stably at the output frequency cannot be built. In these transmitters the oscillator usually operates at a lower frequency, and is multiplied by frequency multipliers to get a signal at the desired frequency.

Circuit Diagram of Rf-Transmitter

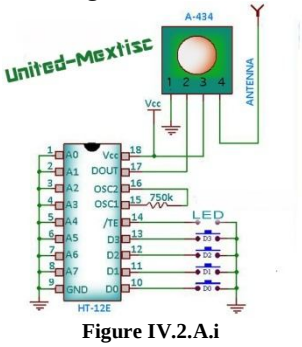


Figure IV.2.A.i

ii. HOW DOES RF-RECIVER WORKS ?

A radio receiver is the opposite of a radio transmitter. It uses an antenna to capture radio waves, processes those waves to extract only those waves that are vibrating at the desired frequency, extracts the audio signals that were added to those waves, amplifies the audio signals, and finally plays them on a speaker.

- Antenna: Captures the radio waves. Typically, the antenna is simply a length of wire. When this wire is exposed to radio waves, the waves induce a very small alternating current in the antenna.
- RF amplifier: A sensitive amplifier that amplifies the very weak radio frequency (RF) signal from the antenna so that the signal can be processed by the tuner.
- Tuner: A circuit that can extract signals of a particular frequency from a mix of signals of different frequencies. On its own, the antenna captures radio waves of all frequencies and sends them to the RF amplifier, which dutifully amplifies them all.

Unless you want to listen to every radio channel at the same time, you need a circuit that can pick out just the signals for the channel you want to hear. That's the role of the tuner. The tuner usually employs the combination of an inductor (for example, a coil) and a capacitor to form a circuit that resonates at a particular frequency. This frequency, called the resonant frequency, is determined by the values chosen for the coil and the capacitor. This type of circuit tends to block any AC signals at a frequency above or below the resonant frequency. You can adjust the resonant frequency by varying the amount of inductance in the coil or the capacitance of the capacitor. In simple radio receiver circuits, the tuning is adjusted by varying the number of turns of wire in the coil. More sophisticated tuners use a variable capacitor (also called a tuning capacitor) to vary the frequency.

Circuit Diagram of Rf Reciever

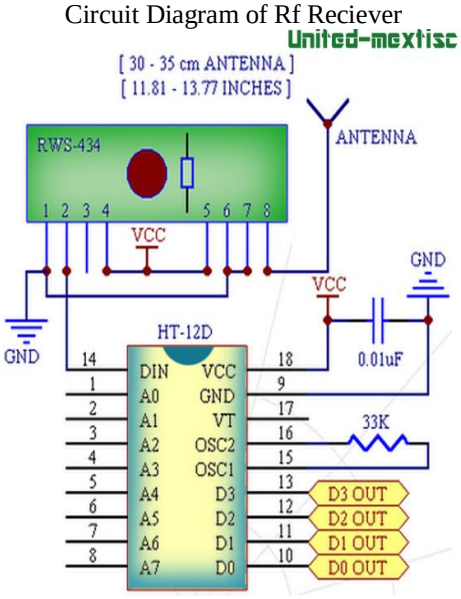


Figure IV.2.A.ii

- Detector: Responsible for separating the audio information from the carrier wave. For AM signals, this can be done with a diode that just rectifies the alternating current signal. What's left after the diode has its way with the alternating current signal is a direct current signal that can be fed to an audio amplifier circuit. For FM signals, the detector circuit is a little more complicated.
- Audio amplifier: This component's job is to amplify the weak signal that comes from the detector so that it can be heard. This can be done using a simple transistor amplifier circuit.

B) WIRELESS CAMERAS FOR MONITORING

i) WHAT ARE WIRELESS CAMERAS?

Wireless cameras are basically described as a wireless transmitter carrying a camera signal. The Camera is wired to a wireless transmitter and the signal travels between the camera and the receiver. This works much like radio. The sound you hear on a radio is transmitted wirelessly and you tune to a certain frequency and hear the sound. Wireless cameras have a channel also. The receiver has channels to tune in and then you get the picture. The wireless camera picture is sent by the transmitter the receiver collects this signal and outputs it to your Computer OR TV Monitor depending on the receiver type. The wireless Camera / Transmitter. The Camera sees the image, the camera then provides the video to the transmitter, then the transmitter sends the wireless signal to the receiver. There are many types of wireless cameras. You can make most any camera wireless by adding a wireless transmitter and receiver. The camera and transmitter require power. The power is provided by battery and/ or transformer / adapter. The complete Wiring for the wireless camera and transmitter end follows. As you can see by (Diagram 1) the camera and transmitter both need power. The camera sees an image, sends it to the transmitter, and the transmitter sends the signal out to the air. The receiver picks up the signal and outputs it to a TV / Computer / Digital Video recorder/ This is a basic diagram many wireless cameras and transmitters are very small and the power is provided to both from one source. A good example of this is an Hidden. IE: A clock radio wireless camera is powered by plugging in the clock. The camera and wireless transmitter are provided power by the clock radio internally.

Block Diagram of Transmitter

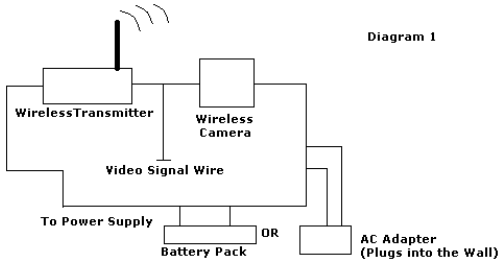


Figure IV.2.B.i

B) THE RECEIVER

A wireless receiver has only one function. After the camera and wireless transmitters have provided the wireless video signal the receiver collects this signal and routes it the Monitor, TV, VCR, DVR or PC (or alternative recording or viewing device). See diagram 2.

As you can see in Diagram 2 the receiver accepts the wireless transmitters signal and then out puts it to your TV, VCR, Monitor or PC. The receiver needs only power and a Device to view and or record the Signal /Video.

Block Diagram of Receiver

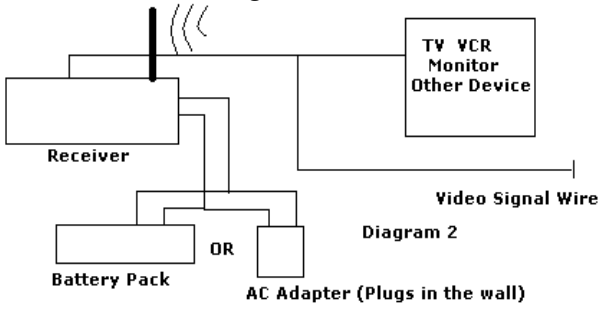


Figure IV.2.B.ii

CONCLUSION

In this way we analyses that using simple cutter mechanism we can save humans life and also can diffuse bombs effectively.

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