DESIGN OF WHEEL ROBOT TO DETECT ANTI-TANK MINES BASED ON NRS MUDA METHODS

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Abstract: *The purpose of this research is to design a robot technology equipped with anti-tank mine detector components. The current anti-tank mine detectors still use personnel to detect the presence of mines. This is considered inefficient because it takes a long time, if not careful it can explode personnel or operators so that the risk factor is very high. Therefore, a robot system is needed that is equipped with a mine detector that can be used to detect mines replacing human tasks, so that the risk factor becomes low and safe. The technology used in the robot is a detector, a transmit-receive control system at a frequency of 563 MHz, a control distance of up to 1km, equipped with GPS so that it can provide information about the presence of mines and inform the controller where the position of the mine is. The method used with NRS MUDA technology is a real-time detection method that directly plots coordinate data where the mine is located and is given a special red marking*

INTRODUCTION

Wheeled robots that use DC motors are one type of robot that moves using wheels and is driven by a direct current (DC) motor. This DC motor functions as an actuator that converts electrical energy into mechanical energy, allowing the robot to move according to the commands given. Anti-tank mines are a type of land mine specifically designed to disable or destroy armored vehicles, especially tanks and other armored fighting vehicles. These mines generally have a greater explosive power than anti-personnel mines, so they can penetrate thick armor on military vehicles. A mine detector is a tool used to find and identify the presence of land mines hidden underground or on the surface. This tool is very important for post-conflict humanitarian operations, military operations, and clearing areas contaminated by land mines, which often leave dangers for civilians and military forces. COM Port (Communication Port) is a serial communication interface used to transmit data between a computer and an external device such as a printer, modem, or microcontroller. In Delphi, a programming language widely used for developing Windows-based desktop applications, COM Port can be accessed to communicate with external devices via serial communication. DTMF (Dual-Tone Multi-Frequency) is a voice coding method used in telephone

communication to send numeric information by pressing buttons on a telephone keypad. The main function of DTMF is to send data via a voice signal consisting of two different frequency tones. This system is used in a variety of applications, including telephone communication, automation systems, and even remote device control.

METHODS

Material

Laptop, Delphi Program Application, Arduino Coding, Protheus, Arduino Uno, Mine Sensor or Detector
Transmitter and Receiver, DC Motor, Camera, Video Sender and Receiver, TV Turner, DTMF Encoder and Decoder.

Methods

The method used in this study uses the NRS MUDA method, namely an experimental method of real-time proof of detector data to be converted into image data which is manifested by a red mark if there is a mine on the plotting map which was originally yellow. Block diagram of the system process starting from data input, then data processing and actuator output to drive the motor is arranged according to Figure 1. Block diagram of how the robot system works.

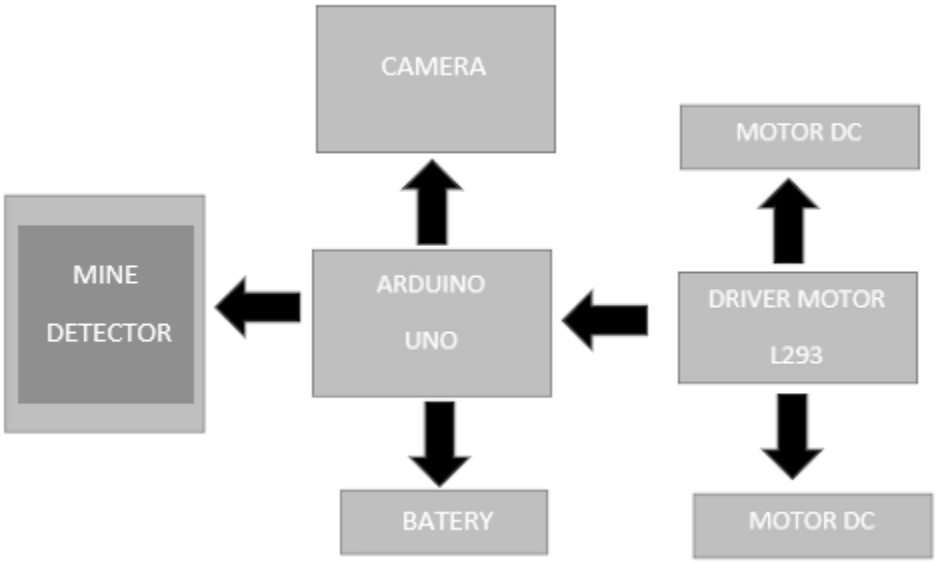

Figure 1. Block diagram of how the robot system works

RESULT AND DISCUSSION

Design of a wheeled robot equipped with an anti-tank mine detector using 3dsmax with dimensions of 80 cm long, 50 cm wide, 30 cm high, detector length of 25 cm, detector diameter of 15 cm, and a total mass of 10 kg as shown in figure 2 wheeled robot design

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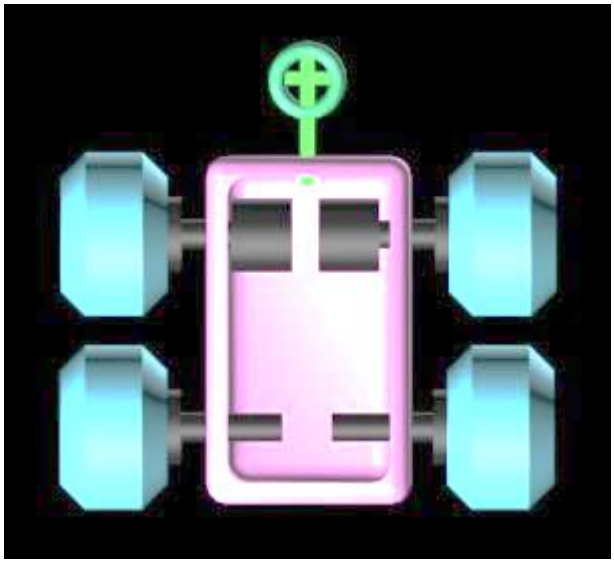

Figure 2. Design of a wheeled robot equipped with an anti-tank mine detector

In order to communicate with the laptop, it is programmed using Delphi, the algorithm of which is set according to the mine data plotting. If the robot successfully detects a mine, a red mark is plotted, and if there is no mine, the color remains yellow as shown in Figure 3. Mine data plotting coding. The control system of the mine detection robot uses an Arduino Uno that works after receiving data input instructions from the transmitter, then processed by the Arduino to drive 2 DC motors as the main drivers of the robot motor. As shown in Figure 3. Arduino Uno and Motor Control Circuit Design

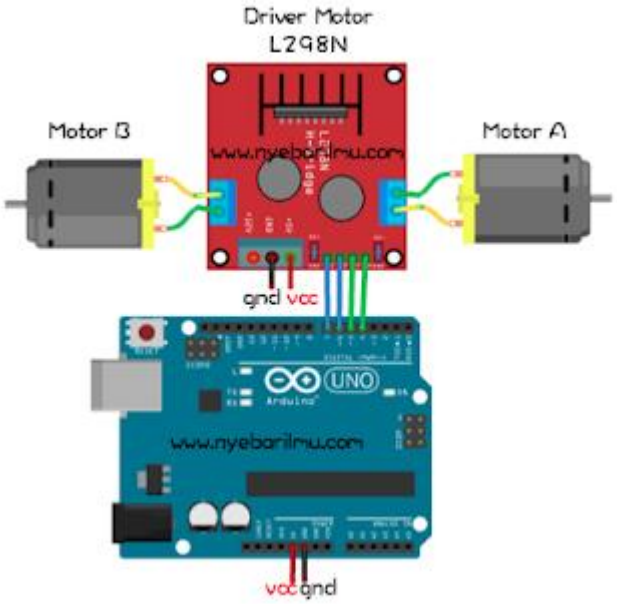

Figure 3. Arduino Uno and Motor Control Circuit Design

```
begin
   Shape14.Brush.Color:= clRed;
   Shape14.Visible:= True;
   Shape13.Visible:= False;
   Shape12.Visible:= False;
   Shape11.Visible:= False;
   Shape10.Visible:= False;
   Shape9.Visible:= False ;
  end
else if (pos='7') and (status='H') then
  begin
   Shape15.Brush.Color:= clLime;
   Shape15.Visible:= True;
   Shape14.Visible:= False;
   Shape13.Visible:= False;
   Shape12.Visible:= False;
   Shape11.Visible:= False;
   Shape10.Visible:= False;
   Shape9.Visible:= False ;
  end
else if (pos='7') and (status='K') then
  begin
   Shape15.Brush.Color:= clYellow;
   Shape15.Visible:= True;
   Shape14.Visible:= False;
   Shape13.Visible:= False;
   Shape12.Visible:= False;
   Shape11.Visible:= False;
   Shape10.Visible:= False;
   Shape9.Visible:= False ;
  end
else if (pos='7') and (status='M') then
  begin
   Shape15.Brush.Color:= clRed;
   Shape15.Visible:= True;
   Shape14.Visible:= False;
   Shape13.Visible:= False;
   Shape12.Visible:= False;
   Shape11.Visible:= False;
   Shape10.Visible:= False;
   Shape9.Visible:= False ;
  End
```

Figure 4. Mine data plotting coding of NRS MUDA methods

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As shown in the coding using the NRS MUDA method where the display of evidence of the control circuit from the mine detector circuit shows the color red and if there are no mines the color is yellow, the simulation is proven using dephi embarcadero Xe 7.

DISCUSSIONS

DTMF (Dual-Tone Multi-Frequency) is a system used to send telecommunication signals. The NRS MUDA Method is used to control a robot using the buttons on the device to send DTMF on 563 MHz carrier Frequency codes and read the codes with a DTMF decoder. In the DTMF coding system, button 2 is used to send a tone signal of tone 2 at frequency of 697 Hz and 1336 Hz to move the robot forward as shown in Figure 4. DTMF signal tone 2 for forward movement.

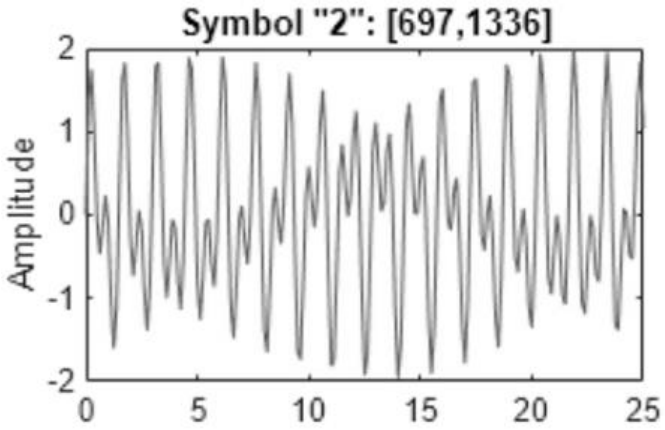

Figure 5. DTMF signal tone 2 or forward movement

When button 5 is pressed, it produces a 4 DTMF tone which is used to move the robot backwards at frequency of 770 Hz and 1209 Hz as shown in figure 5, the 4 DTMF tone signal for backwards movement. When button 5 is pressed, it produces 5 DTMF tones at a frequency of 770 Hz and 1336 Hz which are used to move the robot turn left as shown in Figure 6, the 5 DTMF tone signal for moving to turn left.

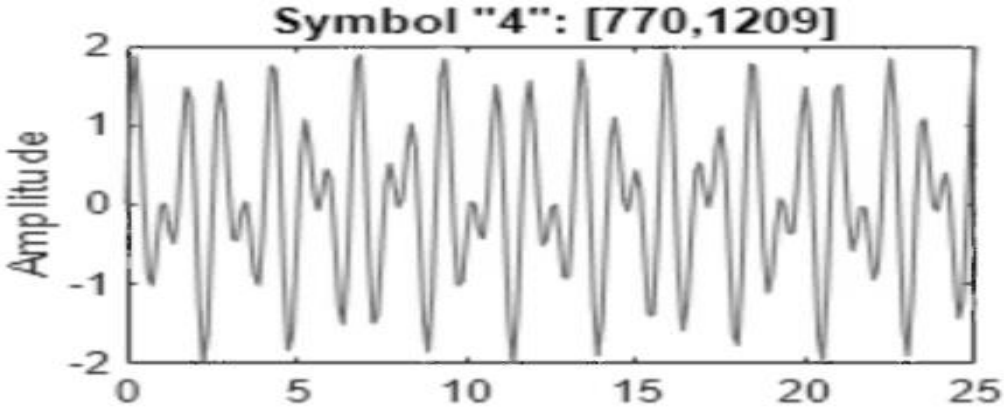

Figure 6. DTMF signal tone 4 or backward movement

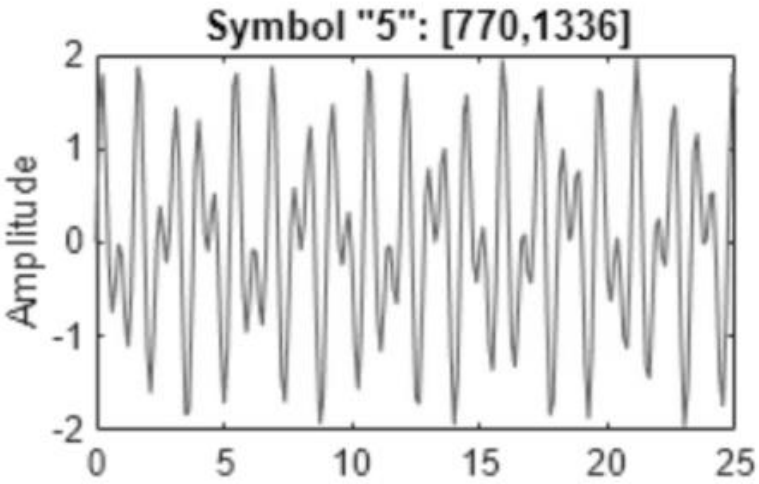

Figure 7. DTMF signal tone 5 or turn left

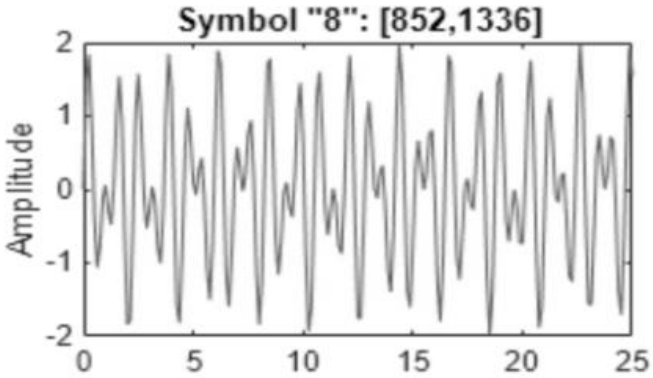

Figure 8. DTMF signal tone 8 or turn right

However, if button 8 is pressed, it will produce 8 DTMF tones at a frequency of 852 Hz and 1336 Hz which are used to move the robot turn right as shown in Figure 7, the 8 DTMF tone signals for moving to turn right. and if the transmitter button is not pressed or the transmitter does not emit a signal tone then the robot is in a stationary state.

Main Components: DTMF decoder (e.g., MT8870): Detects DTMF signals and converts them into digital signals that can be read by the microcontroller. Microcontroller: Receives signals from the DTMF decoder and controls the motor based on the signals. How it Works: 1. Send Code: Press the buttons on the phone to send a DTMF code (e.g., 2 for forward, 8 for backward, 4 for left). 2. Receive Code: The DTMF decoder captures the signal and converts it into digital data. 3. Motor Control: The microcontroller receives data and controls the motor according to the received code. Arduino Code Example for Reading DTMF: cpp Copy the code : #include <DTMFDecoder.h> // For example, use the library for DTMF decoder DTMFDecoder dtmfDecoder; void setup() { Serial.begin(9600); dtmfDecoder.begin();} void loop() { char dtmfCode = dtmfDecoder.getCode(); if (dtmfCode) { Serial.print("DTMF code received: "); Serial.println(dtmfCode); // Implement motor control according to DTMF code

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switch(dtmfCode) { case '2': forward(); break; case '8': back(); break; case '4': left(); break; case '6': right(); break; default: stop(); } } } void forward() { /* Implementation of forward motion */ } void backward() { /* Implementation of backward motion */ } void left() { /* Implementation of left turn */ } void right() { /* Implementation of right turn */ } void stop() { /* Implementation of stop */ } a mine detector works when it encounters a tank mine detectors can use various technologies, such as metallic sensors, infrared sensors, or ultrasonic sensors. Below, I describe how it works using metallic sensors. Metal sensors detect the presence of metal around them. This can be done by detecting disturbances in the electromagnetic field or changes in capacitance caused by the metal. Signal from the Sensor: When the sensor detects the presence of metal (for example, a mine), the sensor sends a signal to the microcontroller. Data Processing: The microcontroller processes the signal from the sensor to determine whether a mine is detected. If yes, the microcontroller can trigger an alarm or indicate the status via an LED or display. Simple Schematic Example with Metal Sensor. Connected to a microcontroller (e.g. Arduino) via an input pin. Microcontroller: Reads the signal from the sensor and determines if a mine is present based on a certain threshold. Output: The microcontroller activates an alarm or indicator if a mine is detected. Arduino Code Example for Metal Sensor: cpp Copy the code const int sensorPin = A0; // Metal sensor pin const int threshold = 500; // Metal detection threshold const int alarmPin = 13; // LED or buzzer pin.

```
void setup() {
Serial.begin(9600);
pinMode(alarmPin, OUTPUT);
}

void loop() {
int sensorValue = analogRead(sensorPin);
if (sensorValue > threshold) {
digitalWrite(alarmPin, HIGH); // Activate the alarm
Serial.println("Mine detected!");
} else {
digitalWrite(alarmPin, LOW); // Deactivate the alarm
}
delay(100); // Wait a moment before reading again
}
```

With the steps and codes above, you can design and implement a wheeled robot control system, a DTMF send and receive system, and a mine detector.

In the DTMF code sending and receiving system, DTMF codes are used to control the robot by sending audio signals from the telephone. A DTMF decoder, such as the MT8870, is used to capture and convert the DTMF signals into digital data that can be read by a microcontroller, such as Arduino. In this way, the commands sent through the telephone can be interpreted by the microcontroller, which then controls the motor according to the received code, such as 2 for forward, 8 for backward, and 4 for left turn. A mine detector, on

the other hand, functions to detect the presence of mines by using a metallic sensor.

CONCLUSION

Mine detectors, on the other hand, function to detect the presence of mines using metallic sensors. These sensors work by detecting disturbances in electromagnetic fields or changes in capacitance caused by the presence of metal. The signal from the sensor is processed by a microcontroller which then determines whether a mine is detected based on a certain threshold. If detected, the microcontroller can activate an alarm or indicator to notify the user. Overall, the application of this technology allows for the control of robots in various effective and safe ways. Controlling wheeled robots requires proper coordination between the motor, driver, and microcontroller. The use of DTMF codes provides a practical wireless method for remote control. While mine detectors rely on metallic sensors for accurate detection, which is very important for safety in exploration applications.

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