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Autonomous Landmine Tracker System

Aniket Koshti[1], Ruturaj Patil[2], Adarsh Jadhav[3] , Anshuman Adate[4], Dr. M. S. Chavan[5]

[1,2,3,4] B. Tech IV, E&TC, Padmabhooshan Vasantraodada Patil Institute of Technology, Budhgaon, Maharashtra, India.
[5]professor, E&TC, Padmabhooshan Vasantraodada Patil Institute of Technology, Budhgaon, Maharashtra, India.

Abstract - *A new solution to the urgent problem of landmine identification and removal is the Autonomous Landmine Tracker System. Landmines seriously endanger civilian populations and hinder post-conflict development initiatives. This proposal suggests an autonomous system that can locate and track landmines effectively and accurately.*

The system uses IOT-related technologies to autonomously navigate dangerous terrain and locate potential landmines. It employs a variety of sensors, metal detectors, to find any hidden landmines. The system can provide detailed coordinates that indicate the position of discovered landmines thanks to real-time data processing and analysis.

Key Words: Autonomous, Microcontroller 328p, GPS, GSM, Metal Detector, Landmine tracker.

1.INTRODUCTION

A sophisticated and ground-breaking initiative called the Autonomous Landmine Tracker System was created to tackle the vital problem of landmine detection. Significant human casualties are caused by landmines. Traditional manual landmine detecting techniques are time-consuming, risky, and frequently ineffectual.

In order to reliably detect and locate landmines, this project intends to construct an autonomous system that makes use of cutting-edge technologies, such as an Atmega 328p microcontroller, a metal detector, and a GPS GSM module. The system integrates these elements to offer real-time information regarding discovered landmines, enabling quick action and secure disposal.

The system's core processing unit, the Atmega 328p microcontroller, controls all system functions. It gathers information from the metal detector and examines the signals to find potential landmine locations. Because it can identify variations in the magnetic field caused by buried metallic objects like landmines, the metal detector is crucial.

The system also includes a GPS GSM module, which enables precise geolocation and communication abilities. For the purpose of detecting landmines and aiding in the planning of mine clearance operations, the GPS module provides precise coordinates where the landmines are found to be located.

2. Theoretical Background of the System

The Internet of Things (IoT) is a ground-breaking idea that has drawn substantial interest in a number of industries, including the one of automatic landmine detection and tracking systems. The Internet of Things (IoT) is a network of interconnected physical objects that have sensors, software, and other technological components that allow them to gather and exchange data online. The system's capabilities, efficiency, and real-time monitoring can all be improved by utilizing IoT in the context of an autonomous landmine tracker.

When IoT technology is used to create an automatic landmine tracker, various system parts, including the Atmega 328p microcontroller, metal detector, GPS, and GSM modules, may communicate with each other without any issues. These devices can communicate with one another via interconnection to share information and instructions, enabling deft decision-making and thorough situational awareness.

The integration of GPS and GSM modules influences the IoT aspect. The device is capable of precisely determining the coordinates of found landmines because to the GPS module's accurate geolocation data. The GSM module enables real-time data transmission, enabling remote monitoring and management of the landmine detection system. Alerts and updates on discovered landmines can be sent to authorities and personnel, allowing them to act quickly and strategically.

Additionally, the IoT architecture enables the collection and analysis of data from several landmine trackers placed in various locations. This information can be used to create heat maps, pinpoint high-risk areas, and streamline landmine clearance efforts. The autonomous landmine tracker can support a thorough and strategic approach to mine clearance by utilizing IoT.

3. Block Diagram of the System

The block diagram of Autonomous Landmine Tracker is shown below. The interfacing of the various electronic components like L298 motor driver, GSM 900A, GPS Neo 6M, Bluetooth HC-05, Metal detector to the microcontroller Atmega 328p is shown below.

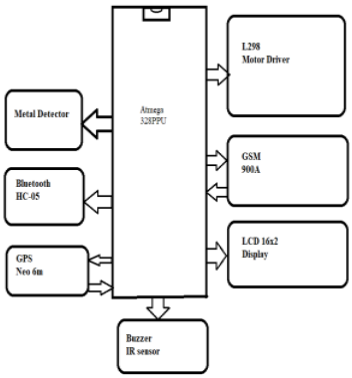

Fig -1 Block Diagram of the system

4. Elements of the system.

The entire system is designed on the three main Units given below i.e.,

- Robot Movement Unit
- GPS and GSM Unit
- Metal Detector Unit

The detailed Explanation of each unit is described below,

4.1 Robot Movement Unit

The important essential elements for the robot movement unit are L298 motor driver and the HC-05 Bluetooth module. The L298 motor driver can be controlled using the Bluetooth commands just by connecting this Bluetooth module to the microcontroller board. The microcontroller thus receives Bluetooth commands from the Bluetooth enabled devices in our case it is a smartphone. The signals received on this are further sent to L298 motor driver to control the direction of the motor.

Table -1: Bluetooth Commands

Commands	Directions
1	Forward
2	Backward
3	Left turn
4	Right turn

4.2 GPS and GSM Unit

GPS (Global Positioning System) and GSM(Global System for mobile communication) is used in the robot to enhance the location tracking and Communication capabilities. The combine use of GPS and GSM is useful for applications like tracking and monitoring of mobile robots. Using the GPS module to track the robot location, the GSM module transmit the location data to the device. This is essential to keep the real time track of the robot.

4.3 Metal Detection Unit

The Metal Detector in the landmine detector robot is used to detect he presence of the metallic objects in the area. The landmine tracking robot works on the principle of electromagnetism. The coil that is used in a metal detector is made such that it can produce a magnetic field. Eddy current is produced when this coil comes in contact with the metallic objects such as landmine. This eddy current produces a secondary magnetic field that interacts with the primary magnetic field. This interaction causes impedance or resonance by altering the electrical properties of the metallic coil. Hence as the result the metal detector identifies this change in the impedance or resonance and identifies the presence of the metallic objects. This allows the landmine tracker robot to locate the potential landmines.

5. Hardware Implementation of the system

The hardware implementation of the system is based on the implementation of the three elements of the system. As a result, the hardware of the system is also implemented on the three main domains.

- Robot Movement Unit
- GPS and GSM Unit
- Metal detector unit

I've gone over the specific implementation in depth below.

5.1 Robot Movement Unit

In this we have connected the L298 motor driver to the microcontroller 328p. The L298 motor driver is connected to D10, D11, D12, D13 port of microcontroller 328p.

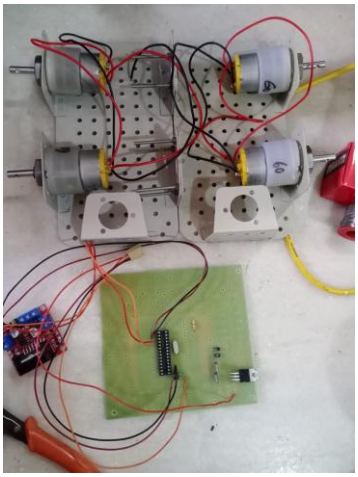

Fig -2 Robot Movement Unit

5.2 GPS and GSM Unit

GPS Neo 6M and GSM Sim 900A are the names of the components used. Thea is interfaced to the microcontroller 328p. The Rx pin of GPS Neo 6M is connected to the 9th port and the Tx pin is connected to the 8th port of the controller. Similarly, the Rx pin of GSM sim 900A is connected to A1 port and Tx pin connected to A0 port of the controller.

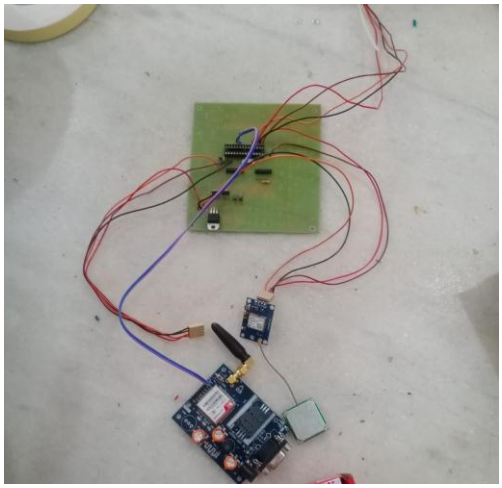

Fig -3 GPS and GSM unit

5.3 Metal Detection Unit

The metal detector model A88 is used in the project. This metal detector is connected to the port A5 of Microcontroller 328p.

Fig -4 Metal Detection Unit

6. Results

The robot movement unit via Bluetooth and L298 Motor driver is successfully implemented and on giving the commands to the Bluetooth HC-05. The robot makes its desired movements.

Fig -5 Bluetooth commands

After making the desired movements when the metal detector detects the metallic object it then stops and sends the exact coordinates to the device. This is done in two ways the first way it sends the coordinates on the Bluetooth application and the second way using the GSM Sim 900A.

Fig -6 GPS coordinates on Bluetooth app.

Fig -7 GPS coordinates via. Messaging

Hence, this is how all the three domains of the autonomous landmine tracker system works together.

7. Conclusion

In conclusion, Autonomous Landmine Tracker plays a very crucial role in mitigating the risks related with the landmines. The system enhances the efficiency of demining operations. The Autonomous Landmine tracker robot significantly pays its contribution toward safety of humanitarian demining efforts, military operations and even border security. They also help in protecting the civilian's populations, facilitate the infrastructure development, and provide safety. The system helps in the mapping and demining the mine effected area, enabling effective planning and prioritization of clearance efforts.

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