

DETECTING AND LOCATING LANDMINES BY USING GPS & GIS ENABLED REMOTELY CONTROLLED ROBOT

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ABSTRACT

Detecting and removing of land mines is generally expensive, dangerous and difficult task where mines were buried on random basis. Manual clearing is the most common technique for clearing minefields. People are exposed to a high risk when they are using hand bomb detecting devices to detect landmines. Using a remotely controlled platform, which carries the bomb detector, can reduce the risk.

Mine clearance project can be done in an efficient way if we can implement a GIS System to locate the exact positions of the detected landmines on a local map of the area. Then the GIS database also can be used to educate the community about the landmine contamination of their environment. Main purpose of this project is to detect landmines by using a GPS enabled remotely controlled robot and inserting the positions of the detected landmines to a GIS database. Positions of landmines are displayed on a GIS map.

1.0 INTRODUCTION

Robot is designed to detect landmines in a remotely controlled way. User can navigate the robot and locate the landmines and update them into a GIS database. Updated locations can be viewed by a desktop application or a web based GIS system. Locations of detected landmines can also be accessed by mobile phones via GPRS and SMS.

The robot can be controlled by the developed software, which will program the parallel port and communicate with the robot via radio signals. Developed software program uses button and mouse control to navigate the robot.

The developed software will indicate the real-time location of the robot and the location is transmitted via bluetooth connection to the control station from the bluetooth enabled GPS which is attached to the robot. Other supportive GIS layers like roads, railway, administrative boundaries, forests, tanks and etc will also be displayed on the control screen. These supportive layers will be helpful to the user to get an idea about the surrounding area, which is contaminated with land mines.

When the robot detects a landmine it sends the signal to the control station (software developed). Then the system will add a Point Feature with predefined attributes such as Latitude, Longitude, Time, Amplitude of the Signal and etc in to the Shape File, which gives the

details about the detected landmines. Position of the Robot will also be added to the predefined Shape File, which will indicate the current position of the robot. Therefore user can handle the robot and navigate the robot by looking at the map on the screen.

2.0 METHODOLOGY

2.1 The System Architecture of The Robot

System consists of two main modules, which are the control station, which runs on a PC or Laptop and the remotely controlled robot. The control station consists of three integrated modules consisting of Metal detecting component, GPS data collecting component and Remote control component. These three components act as one system but the underlying system components act as simultaneously working independent systems.

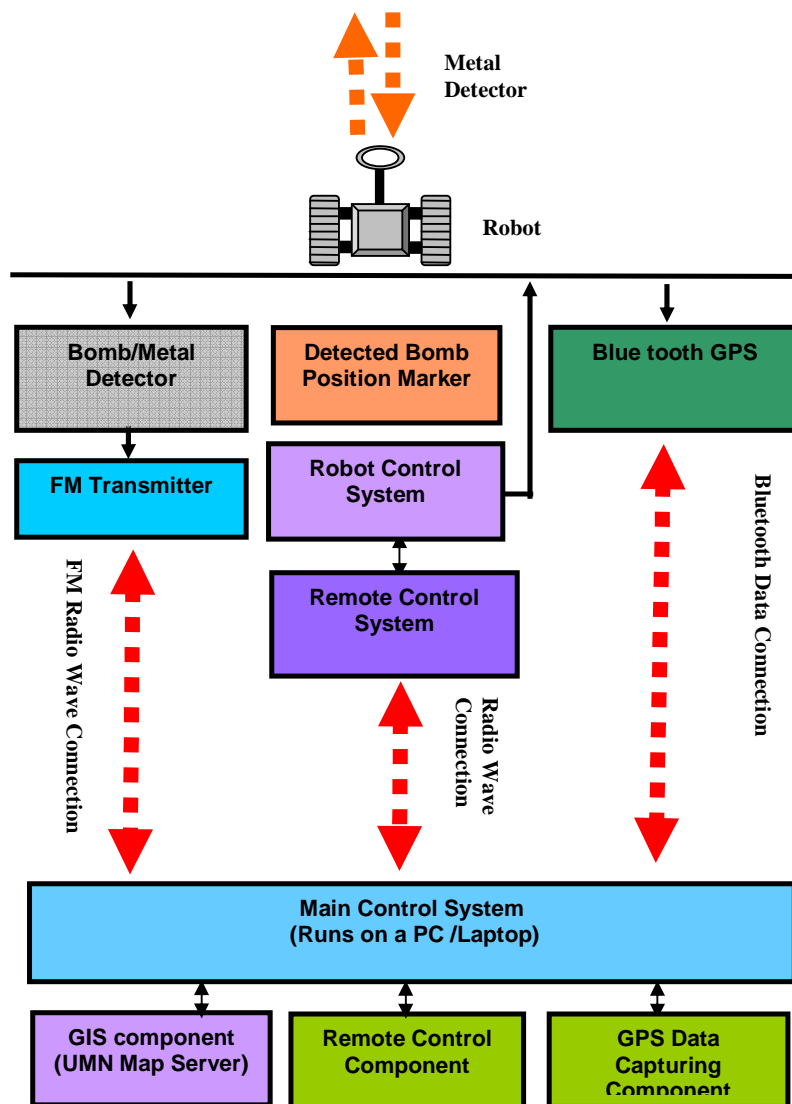


Figure (01)

Remote control system uses a radio frequency transmitter. Control system, which runs on a PC or a Laptop, uses the parallel port and control relays to remotely control the robot. Bluetooth GPS sends the location of the robot via bluetooth data connection. Controlling software of the GPS acts as an intermediate layer, in the communication between the developed software and the robot. GPS component of the developed software reads NMEA data via communication port of the PC or the laptop. The software decodes NMEA data and the location of the robot is displayed on the map. UMN map server is used as the GIS software, which serves the GIS layers to the developed software.

If the robot detects a landmine by using its metal detector then it sends a radio signal by using a FM transmitter. Then the signal is captured by a FM receiver which is attached to the control system and then system recognize the position of the robot as the landmine contaminated location and adds a point feature to the landmine point layer in the GIS database.

2.2 Screen shots of the Developed Software for the Control Station of the Robot

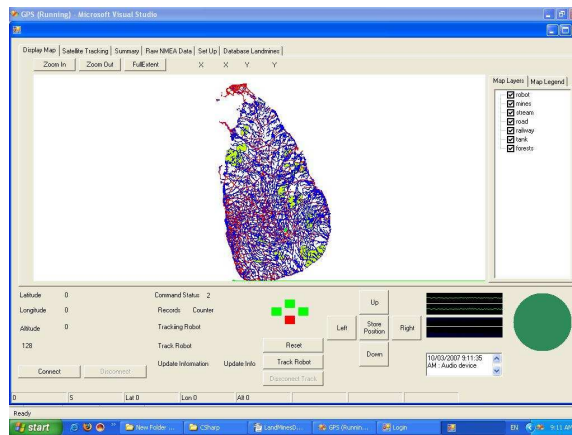


Figure (02)

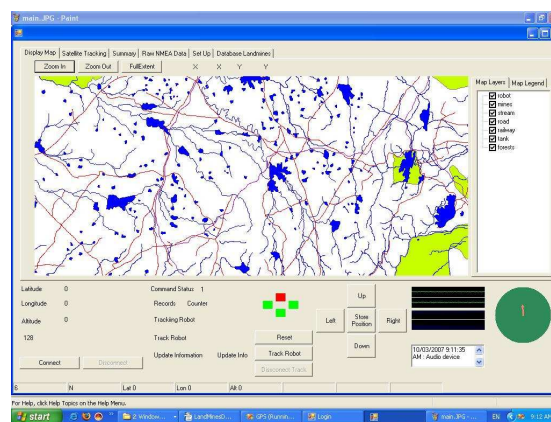


Figure (03)

2.3 GIS, GPS Capabilities and Other Features

Location of the robot is tracked in real-time by using the bluetooth GPS and the developed software extracts the NMEA data. Then the real time location of the robot is added to the point layer. These point layers are in shape file format. If the robot tracks a bomb, the location is also inserted to another point layer reserved for tracked landmines. UMN Map Server is used as the GIS map serving software. Map script dynamic link library file does the communication between the maps server and the developed software. WGS1984 is used here as the datum for all the GIS layers, as it is the datum, which is used in the GPS. Supportive layers were added to the software as a framework for getting an idea about the local area, where the robot navigates.

RESULTS & DISCUSSION

LandMine_ID	Latitude	Longitude	Altitude	Time
1	80.52	6.45	1000	2008/10/20,2:20:10
2	80.22	6.79	1001	2008/11/21,1:21:12

Table (01)

Location details and other details of the detected land mines can be illustrated as indicated in table 01. A Web GIS also can access locations of the detected landmines. By using this facility the user will be able to access the map but cannot control the robot. This project focuses on the detection of landmines, locate them and update details in a geographical information system. De-mining part also can be developed in further research.

CONCLUSION

This project developed could be viewed as a low cost simple system to detect landmines and locate them in a localized map. Users can access the locations of the detected landmines by using a desktop application / web based application. The robot used in this project is of very primitive type and as further developments the robot can be developed to a state, which it is capable of de-mining the detected landmines.

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