Automatic Landmine Detection using Robot

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***Abstract*:- The Landmine detecting robots are designed to cover maximum possible area of landmine field for detection of landmines. The detected landmines along with scanned and leftover area are represented on a visual map with accuracy in millimeters. This paper presents a prototype model of land mine detecting robot that is powerful yet low cost and easily controllable. A graphical user interface is developed for plotting the landmines, scanned & leftover area presentation, PID tuning and camera alignment. Emphasis is placed on the control of the differential drive robot in auto mode, semi-auto mode and the manual mode. Image processing technique is employed to find the accurate position of robot which provides the live reckoning feedback to the dead reckoning servo control of the robot. Metal detector is the sensor used to detect landmines. The graphical user interface for the remote terminal computer provides the effective control for the robot. The system is simple but powerful and intelligible to achieve the required results.**

Keywords: Automatic Robot, Changing Place of Landmine, Landmine Detection, Micro-controller based Robot.

1. INTRODUCTION

National security is of prime importance in today's weapon studded world and therefore the need to consider safety of the army personnel and people living in war prone areas becomes very vital. A Landmine is basically an explosive device hidden underground by the enemy and explodes when any personnel or vehicle steps or drives over it. The Pressure created by the personnel or the vehicle on the ground below which the mine is laid acts as the detonator for the mine explosion [1]. The damage caused by the Landmine explosion is fatal and hence detecting landmines becomes necessary before the army personnel or vehicle accidentally steps over it. The major challenge is detecting these landmines without causing any explosion and diffusing them once they are detected. The process of detecting landmines is technically termed as minesweeping and process of removing or defusing the mines is known as demining or mine clearance. Minesweeping was earlier done using trained animals like dogs and rats but modern methods includes metal detectors and various tooled attached to the vehicles. But any manual intervention of a human is always dangerous. Robots are used for various applications in industrial area [2]. Robot performs various activities and is becoming more advanced. That's the reason nowadays Landmine Detection Robotic Vehicles and unmanned robots are used to detect the landmines. Robots are always reliable in terms of perfection in detection and no human life is endangered in the process. An automatic robot, which is capable of detecting buried landmines and taking from their locations, while enabling the operator to control the robot wirelessly from a distance [3]. The detection of the buried mine is done by using metal detectors since most land mines contain metal components. The robot will travel in a zig zag path [4]. The system allows the operator to stay at a safe distance by enabling him to control the robot wirelessly or remotely.

2. EXISTING SYSTEM

GPR has been considered as the most promising subsurface sensing technique for landmine clearance operations in combination with a metal detector. This is because of its ability to detect both metallic and nonmetallic landmines. Furthermore, the capability for imaging and post processing of data enables the identification of detected objects. A system combining GPR and a metal detector is commonly called a dual sensor. The system uses the metal detector as the primary sensor for the detection and localization of metal-containing objects, after which it switches to GPR as the secondary sensor for target identification. GPR for landmine detection commonly employs relatively high frequencies in order to detect and/or image small objects near the surface and also to reduce the size of the antennas for easier handling and higher mobility. With high frequencies, GPR becomes more sensitive to the heterogeneity of the media surrounding the object, which results in unwanted scattering in the data. The unwanted scattered waves are commonly referred to as clutter. Clutter degrades the quality of the GPR data and makes their analysis and interpretation difficult. In the case of landmine detection, a false analysis or interpretation of the data may lead to an accidental detonation

3. PROPOSEDSYSTEM

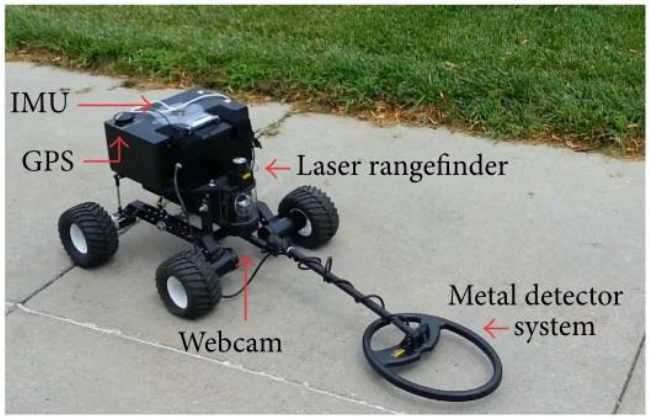

Fig.1 Prototype of Landmine Detection Robotic

In our proposed system a robot with a wheels which performs mine detection. Because there are many personnel

mines remaining from wars, it is desirable to provide a safe, inexpensive tool which civilians can to detect the mines. The robot has a capability to detect the path of going forward and backward. The movement can be done with the motor which has been turn easily. Normally the wheel conducting vehicle facing hard to turn left or right but our robot does not create those issue. It is common to evaluate the performance of a metal detector by calculating the probability of detection

4. ATMEL89S52

Low-power, high-performance CMOS 8-bit microcontroller with 8KB of ISP flash memory. The device uses Microchip high-density, nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. On-chip flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. This powerful microcontroller is suitable for many embedded control applications.

4.1 AT89S52 Microcontroller

The AT89S52 comes from the popular 8051 family of Atmel Microcontrollers. It is an 8-bit CMOS microcontroller with 8K as Flash memory and 256 bytes of RAM. Since it is similar to the trust worthy 8051 architecture these microcontrollers are as per industry standard. It has 32 I/O pins comprising of three 16-bit timers, external interrupts, full-duplex serial port, on-chip oscillator and clock circuitry. The Microcontroller also has Operating mode, Idle Mode and Power down mode which makes it suitable for battery operated applications [7]. Few considerable drawback of the microcontroller is that it does not have in-built ADC and does not support SPI or I2C protocols. However you can utilize external modules for the same.

4.2 Programming AT89S52 Microcontroller

Atmel microcontroller can be programmed with different software's that is available in the market. Arduino, Keil u Vision is the most used platforms to name a few. If you are planning on serious programming and expansion with community support then Keil is recommended. In order to program the Atmel microcontroller we will need an IDE (Integrated Development Environment), where the programming takes place [9]. A compiler, where our program gets converted into MCU readable form called HEX files. An IPE (Integrated Programming Environment), which is used to dump our hex file into our MCUs.

➢ ***To select Atmel Microcontroller***

Microchip provides a vast variety of Microcontrollers from PIC family and Atmel Family. Their collection has just piled up after Microchip has acquired Atmel. Each MCU has its own advantage and disadvantage. There are many parameters that one has to consider before selecting a MCU for his/her paper. The below points are just suggestions which might help one to select a MCU.

- If you are a beginner who is learning Microcontroller then, selecting a MCU that has good online community support and wide applications will be a good choice. For Atmel AT89S52 or ATmega328 will be a good choice.
- Consider the operating voltage of your system. If they are 5V then select a 5V MCU some sensors or devices work and communicate on 3.3V in such case a 3.3V MCU can be selected
- If size and price is a limitation then you can choose small 8-pin MCUs like Attiny1614. These are also comparatively cheaper.
- Based on the sensors and actuators used in your paper, verify which modules you might need in for MCU. For example is you are reading many Analog voltages then make sure MCU has enough ADC channels and supportive resolution. The details of all modules are given in the table above.
- If you paper involves communication protocols like UART, SPI ,I2C, CAN etc make sure you MCU can support them. Some MCU can support more than one module of the same protocol

➢ ***Applications***

- Multiple DIY Papers
- Very good choice if you are learning ATmel
- Papers requiring Multiple I/O interfaces and communications
- Replacement for Arduino Module
- Ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications.

➢ ***HT12D:***

HT12D is a 2^{12} series decoder IC (Integrated Circuit) for remote control applications manufactured by Holtek. It is commonly used for radio frequency (RF) wireless applications. By using the paired HT12E encoder and HT12D decoder we can transmit 12 bits of parallel data serially. HT12D simply converts serial data to its input (may be received through RF receiver) to 12 bit parallel data. These 12 bit parallel data is divided in to 8 address bits and 4 data bits. Using 8 address bits we can provide 8 bit security code for 4 bit data and can be used to address multiple receivers by using the same transmitter [10].

HT12D is a CMOS LSI IC and is capable of operating in a wide voltage range from 2.4V to 12V. Its power consumption is low and has high immunity against noise. The received data is checked 3 times for more accuracy. It has built in oscillator; we need to connect only a small external resistor. As HT12E, it is available in 18 pin DIP (Dual Inline Package) and 20 pin SOP (Small Outline Package)

➢ ***HT12D Decoder Timing:***

HT12D decoder will be in standby mode initially ie, oscillator is disabled and a HIGH on DIN pin activates the oscillator. Thus the oscillator will be active when the decoder receives data transmitted by an encoder. The device starts decoding the input address and data. The decoder matches the received address three times continuously with the local address given to pin A0 – A7. If all matches, data bits are decoded and output pins D8 – D11 are activated. This valid data is indicated by making the pin VT (Valid Transmission) HIGH. This will continue

till the address code becomes incorrect or no signal is received.

➢ ***HT12E Encoder IC for Remote Control Systems***

HT12E is a 2^{12} series encoder IC (Integrated Circuit) for remote control applications. It is commonly used for radio frequency (RF) applications. By using the paired HT12E encoder and HT12D decoder we can easily transmit and receive 12 bits of parallel data serially. HT12E simply converts 12 bit parallel data in to serial output which can be transmitted through a RF transmitter. These 12 bit parallel data is divided in to 8 address bits and 4 data bits. By using these address pins we can provide 8 bit security code for data transmission and multiple receivers may be addressed using the same transmitter.

HT12E is able to operate in a wide voltage range from 2.4V to 12V and has a built in oscillator which requires only a small external resistor. Its power consumption is very low, standby current is 0.1µA at 5V VDD and has high immunity against noise. It is available in 18 pin DIP (Dual Inline Package) and 20 pin SOP (Small Outline Package)

The HT12E 2^{12} series encoder starts a 4 word transmission cycle upon receiving transmission enable signal on TE input. This output cycle will repeat as long as the transmission is enabled. When the transmission enable (TE) signal switches to HIGH, the encoder output completes the current cycle and stops as shown above. The encoder will be in the Standby mode when the transmission is disabled.

5. CONCLUSION

Nothing should be more important than the lives and safety of our country's army men who risk their lives for our safety from external enemies. There have been many cases of fatalities and injuries due to explosion of landmines. Till date a lot of research and development has been done and different types of landmine detection robots have been developed each having its own advantages and disadvantages. The variation in these robots is based on the controller or processor used, sensor interfaced, GPS tracking system and the locomotion technique used.

6. REFERENCES

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