Landmine contaminated area scanning robot

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Introduction

Landmines pose serious threats for post conflict countries like Sri Lanka. There are nearly 120 million landmines all over the world today. Unlike other weapons, landmines are long term killers and function long after a war is over. It kills and maims more than 20,000 civilians per year (World Vision. 2009. About Landmines. United States: World Vision). Clearing the burial mines by human is lethal. Though autonomous mine detecting machines are available, the cost is high and one shortage of the systems is not providing a map of the scanned area. Therefore the percent work aim to design a prototype of an economical autonomous robot which facilitates the mine detecting and map generating of buried places.

Methodology

The black color marks in a white background were considered as landmines and IR sensors were used as detectors. The complete design is consisting of detectors, carrying vehicle and controlling unit. There are three detectors which are placing in three sides of the robot and each detector consists of five IR sensors. The analog signals of the detector were converted in to digital by using the LM 339 comparator. The separate presets were used to adjust the reference voltage with the comparator. The LED bulbs were placed in front of the sensors to avoid the disturbance of infra-red rays of the sunlight. The detector of the moving side was only activated at a time and other two were deactivated in that time.

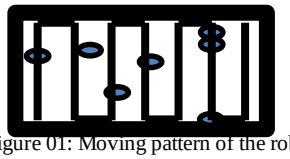

Figure 01: Moving pattern of the robot

The robot has to scan the total area and the moving pattern of the robot is the most important part and key feature of the design. It moving on straight lines and moving perpendicular direction without turning. The special wheel was used for this function and the wheels have cylindrical rollers to reduce the friction when it is moving in perpendicular direction. The robot is moving by using the two pairs of wheels. The two pairs wheels arranged in perpendicular direction and driven by gear motors. The L 293 motor drivers were used to control the motors. The 12V 6800mAh li-ion rechargeable battery was used as the power supply of the robot and the power transmission was done by using the L7805 regulators. The powers for the motors were supplied through the two 1000 micro farad capacitors. It avoids the restart of the processor because of the over consumption power of the motors. The regulated power was smooth further and given to the processor. All of the operation was processed by the Arduino Mega at mega 2560 microprocessor. The robot is moving 1m front while scanning the area and doing the serial communication. Then stay 1 second for stable the robot and moving 20cm perpendicular direction and after 1 second delay it is moving back. Then again do the perpendicular movement. The serial communication is occurring while these movements. This process is repeating 5 times again and again. The counter was used to control the repeating times of the cycle. The real time data communication was done by serial communication and data received by a serial terminal. The USB port was functioning as the virtual serial port. The communication port and the baud rate

should be same. Baud rate can be set as the requirement. The predefined Matlab application generated the map.

Results and Discussion

The robot was moving in straight paths and perpendicular direction almost accurately. The coordinates of the each point is showing in the serial terminal and when the landmines available it is mark as 'BOMB DETECTED'. The selected coordinates should be in put to the Matlab application and the predefined Matlab application plots the coordinates as a map. The processor takes little delay to clear the digital signal taken earlier hand then bomb available signal is indicated after passing the bomb. The loop time of the serial communication adjusted to avoid the over detection of the same mine because of that clearing delay. The power of one regulator is not enough for the entire process and each detector; motors are powered by separate regulators. The robot can start through the serial communication.

Conclusion

The objectives of the projects are almost overlapped with the results. It facilitates to identify the burial land mines without enter to the contaminated area by humans. The fully automated rower reduces the exposure of the human with the mines and reduces the lethal damages. It accelerates the clearing process effectively. The limited resource for making the rower is a challenge. The real time data communication is more secure than the data storing in the memory. It facilitates to identify the current situation of the ground before rower reaching to the end and in accident situations of the rower. Using serial terminal is more easier and time saving than direct communication with the Matlab. Controlling the serial communication through the Matlab is complicated.

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