

2. Executive summary of the project

This report covers the work done at the Industrial Automation Research Center of the University of Moratuwa to develop a low cost robotic solution to improve the safety and speed of landmine detection in Sri Lanka. In the design process, we have paid much attention to the contextual facts such as the vegetated environment in which the robot should navigate, the maximum weight of the robot so that the typical anti-personal landmines in Sri Lanka will not be triggered, the distribution of metal debris in typical battlefields, the rugged terrain conditions, and the affordable cost of a robotic solution.

2.1 Development of a legged mobile robot to carry a mine detector in a vegetated environment: In a typical landmine detection task in a tropical country like Sri Lanka, the robot has to move in a vegetated environment with rough terrain conditions because the land has been a former battlefield. According to the feedback we received from the manual demining units, they prefer to have a robot that could be carried in a back sack and assembled easily on the site. Moreover, most anti-personal landmines explode for any load beyond 7kg. Therefore, the robot should be as lightweight and autonomous as possible. There are other requirements like cost effectiveness and simplicity of the navigation algorithms. The most cost effective detectors are commercially available metal detectors. In order to get an acceptable penetration into the ground, there is a minimum size to the metal detectors, usually a dial with around 15 cm diameter. To carry these metal detectors, and to navigate within an acceptable speed limit, there is a limit for the minimum size of the robot.

After a number of experiments with different robotic platforms, we designed a robot that looks and walks like an Iguana frequently seen in tropical forests in Sri Lanka. **Figure 2.1**, shows the laboratory made robot that weighs 4 kg. The legged robot consists of two independent units, each resembling the shape of an Iguana. The two units are kept together using two rods hinged at the front and the rear end of each unit. Two units are driven by two geared DC motors that can be controlled independently. Therefore, turning involves one unit moving faster than the other, or one unit reversing while the other unit moves forward.

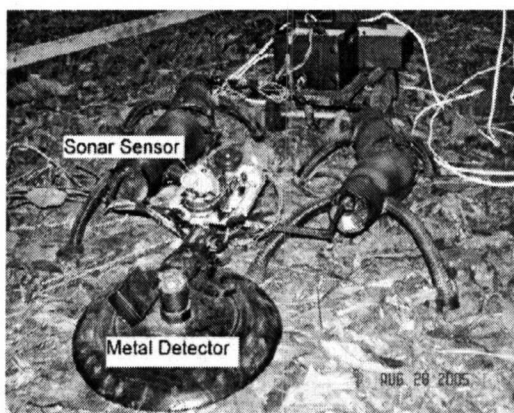


Figure 2.1: The legged mobile robot

Converting a Landmaster tractor to an autonomous robot to do demining in a highly vegetated environment: This project is being done by a group of undergraduate students in the Department of Mechanical Engineering. They are due to submit their final prototypes by the end of September, 2005.

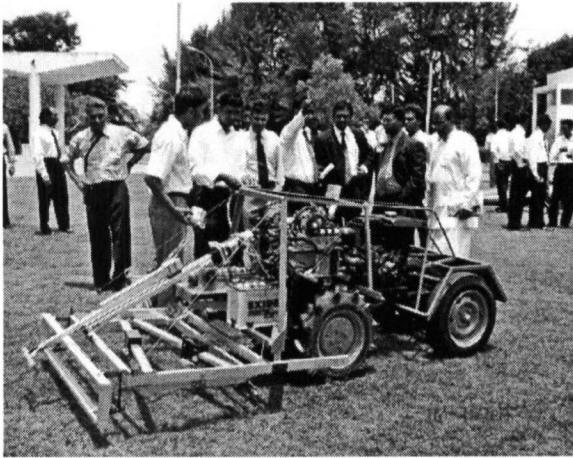


Figure 2.2: The modified tractor to work with thick vegetation

2.2 Developing a robotic manipulator to remove landmines: After having studied several options for landmine removal, we decided to automate the present manual method of landmine removal practiced by the Engineering Brigade of the Sri Lanka army, who are the primary Government party to do demining in Jaffna. The method involves using a rake to scrape the ground to remove landmines. Since this process has already led to few accidents, we are making an attempt to improve the force profile exerted on the ground and program the optimum scraping behavior using a robotic manipulator.