

Intelligent Training Aid

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Abstract: *The Deployment of ITA is in the direction of developing the unique firing skill into the soldier. The proposed system is portable, simple, and cost effective and resource saving equipment which can be utilized by troops even during small breaks in the deployment to practice their weapon training and remove the need to carry out firing practice at SA ranges. This equipment can be issued down to platoon level and can be utilized by platoon commanders to train their command in basic as well as advanced firing drills and also improve the accuracy and consistency of SA firer without resorting the actual firing as well as during actual firing. The proposed system is Matlab based system with RF communication. It provides the miss distance of aim point from target point as well as of bullet from an aim point passes through the target plane. Initial work indicates that a low-cost solution can achieve millimeter-level accuracy irrespective of velocity over a wide range of environmental conditions.*

Keywords: ITA, SA, Matlab, RF

1. Introduction

The involvement of the Indian Army in ensuring safety of our citizens is increasing day by day. This causes troops to man installations/check points/secure routes etc. for prolonged durations, leaving them with little time to hone their firing skills. To develop the firing skills a virtual target device is used by the troops to conduct the small arm firing training sessions. In the training of a soldier for small arms fire this virtual target System has been deployed in which firer could see his fire point shots after the allotted firing session. During this session he could not able to see his individual fire point, as well as there is no such provision to see aim point. The proposed system has been deployed with help of Matlab based digital image processing technique and RF communication which can automatically log the miss-distance of each bullet as well as the aim point and relay this Information to the shooter. The system designed keeping the instruction required to be impacted by the instructor during the training session with the help of bidirectional PA system.

A low-cost solution has been sought which would overcome the problems of existing systems, operate in all conditions (indoors and outside) for all bullet velocities and yield an accuracy of about several mm. A prototype system has been designed. More recently, the system has been further developed into a working prototype virtual targeting system. (ITA).

Based on the requirement of a smart training aid the system has been developed to provide the miss distance of aim and fire point by the firer during firing training session. A trigger mechanism has been developed in such a fashion that when firer pressed the trigger of weapon, then a LASER for aim point and LASER for hit point on target is being recognized by capturing the two images with single triggering, at the same time the sound of fire is generated and the jerk is going to be created on the soldier's shoulder by using pneumatic system. So as to process this digital images into MATLAB

and with each individual fire, every aim point and fire point get the number according to sequence how they got captured at the same time programming also provide the distance/displacement of this aim point and fire point from main target point and aim point respectively. When such individual fire is being done by the firer could able to see his fire and aim point on the screen provided besides to him. After ending process of allotted firing session for particular number of shots all the fire and aim point is being displaced on the target image with table showing the miss distance of fire and aim point as well.

2. Literature Survey

To develop the firing skills an existing virtual target device is used by the troops to conduct the firing training sessions. The system has developed in a way that fixed time duration is allotted to the fire for firing. During this period of time he has to fire the number of shots on the object which he could see on the screen. The weapon came into the practice is actual one except instead of firing the actual bullet it fires the IR LASER beam by the IR LASER unit placed at the mouth of the barrel of the weapon. A trigger mechanism has been developed in such a fashion that when trigger of weapon pressed it will fire the IR LASER on the object screen and simultaneously the sound of fire is generated and the jerk is going to be created on the soldier's shoulder by using pneumatic system.

Now the number of hits on the object is going to detect on the principle of recognizing the IR LASER spots by the IR detectable camera so, the number of IR spots catch by the camera is equal to the number of shots fired and the assignment of serial number to this shots is done by the software. Now the fire could see the pattern of his hits on the screen after the firing session has been finished where he come to know where and how many shot he has fired during the firing session. The drawback of this system is that.

- Firer will able to see his all fired shots only after finishing the firing session.
- Inconsistent and Haphazard Conduct of Weapon Training.
- Inadequacies of Outdoor Range Course.
- Lack of Emphasis in Current Range Course on Grouping.
- Coaching to firer has Become Subjective.
- Tendency of Corrections Not Possible during Course of Shooting.
- To Score a Hit and Not Accuracy.
- Unrealistic Firing Practice.
- Improper Recycling Of Firers.
- Lack of Time to Concentrate On Weak Firers.
- Not Imparting Requisite Training Coaching For Fire

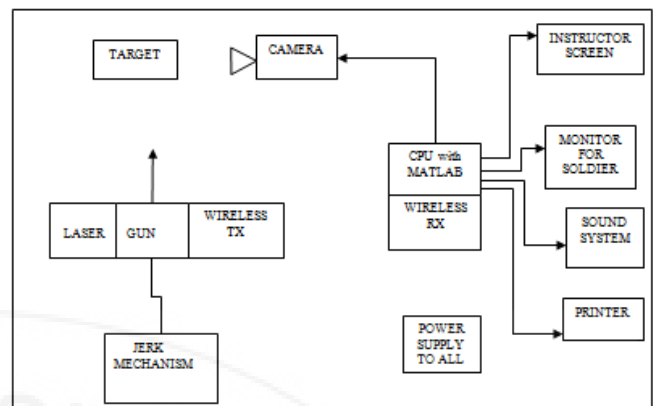


Figure 1: Block diagram

3. System Development

ITA consists of the high resolution camera is fitted near the target and synchronized with the target. The CPU with MATLAB software is connected to camera. The Gun Laser Unit is fitted on the weapon with the help of bracket and zeroed with the help of adjustable micrometer mechanism. Another laser is fitted inside the gun barrel to get the aim point. An operating switch is incorporated in trigger mechanism. The laser trigger and the camera once synchronized and progress alignment is checked on the screen makes get the system ready to commence shooting. On pressing the trigger a high intensity laser beam get fired like a shot and when it strikes the target the two image will captured by the camera and computer stores the captured image. The image is going to capture in two parts, first when immediately pulling the trigger which show where firer is aiming and later when the trigger is pressed completely the laser which fires like a shot hits the target and then second image has been captured. The system is in cooperated with the audio system and Jerk System which given the effect of actual sound and actual jerk as heard and feel during actual firing. The Graphical user interface screen provides the various operating buttons to operate on various options during the process of shooting. The display screen placed next to the firer displays both the image shot being fired and the actual shot with correct measurements from center of the target as well as from the aiming point as indicated by the laser. The firer thus able to see the pattern of his hits and can take necessary corrections. The system designed keeping the instruction required to be impacted by the instructor during the training session. The instructor has complete control of the shooting program in progress; he can at any stage stop/interfere during the processes of shooting by means of wireless communication and pass necessary instruction including recommending the shooting program. All data/results of various shooting reports can be generated to record as well as to carry out analysis of the shooting of particular firer. Printouts for individual soldier for data analysis and its corrective actions can be taken.

Various Attributes

- 1) Jerk mechanism- A Pneumatic System which has installed in such fashion that when trigger is pressed a cylinder operated by 3/2 solenoid valve is being operate and it gives jerk on the shoulder of firer as like jerk of actual firing.
- 2) Wireless TX-RX- The RF TX-RX pair is used to send the trigger pulse from Weapon to the CPU on every trigger pressing.
- 3) Sound system- The sound system such as wireless headphone is provided for firer so as to get sound which gives the effect of actual sound
- 4) MATLAB- Matlab is high level language and interactive environment for numerical computation, visualization and programming. It is such tool by using which we can analyze data, develop algorithm, and create models and applications. Here we have used it for digital image processing which processes the captured image of target. Also to display all the target images with all fire and aim point we also have developed a GUI into the MATLAB which is special feature of Matlab.

4. Relevance of Project

This project can be used in Defence especially in Army for firing training purpose.

5. Results

The work is completed with the finding of fire point and aim point measuring its distance from the centre of the target. These are different frames captured with sequence of trigger pressed and showing the fire point with the individual images captured.





Figure 2: Frame showing 1st, 2nd, 3rd, 4th and 5th fire point with distance from Centre

Sr.No	A(cm)	F(cm)	D(cm)
1	3.21	14.52	11.31
2	4.5	8.72	4.22
3	2.0	26.99	24.99
4	3.1	23.72	20.62
5	6.0	15.09	9.09

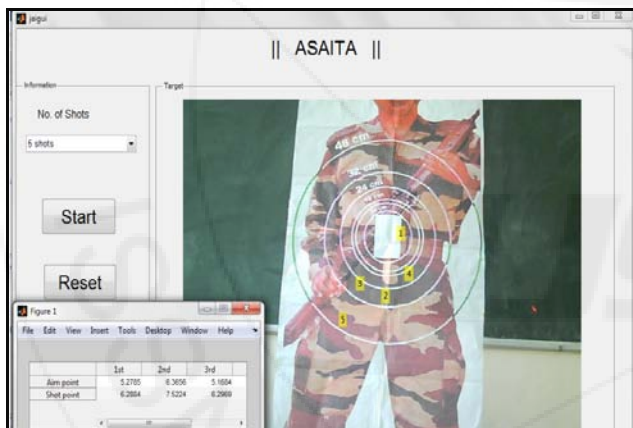


Figure 3: Frame showing all fire and its aim point with distance from centre

In the existing system firer does not have the knowledge of the aim point, fire point during the session and distance by which shot get missed from aim. The results of proposed system shows the completion of recognizing the aim point and fire point for all the shot fired by the firer as well as distance between the same. And this can be seen by the firer during the firing session which is helpful to firer so that he able to see pattern of his fire and can make corrections of each shot which is not possible in existing system.

6. Acknowledgment

Completion of this system is a task which would have not accomplished without cooperation and help from my guide. At the outset, I wish to express my deep sense of gratitude to my guide Prof. R. M. Autee (Head, Electronics &

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