UNIVERSITY OF MORATUWA

IMPROVEMENT OF WEAPON LOCATING RADAR CONTROL SYSTEM WITH VISION-BASED TARGET VERIFICATION

SRI LANKA

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DECLERATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

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ABSTRACT

Weapon locating radar control system with vision - based target verification is an important apparatus in real-time battle planning. It provides present situation of the battle field to the field commanders, so that they can make most accurate decisions. In the radar control system for vision base military fire finding, the most important feature is the presentation of live video taken by UAVs (Unmanned Aerial Vehicle) to help locate potential targets such as heavy weapons of the enemy. During the war, weapon locating radar played a vital role by locating ballistic weapons of the enemy and helping out ground forces to destroy them before they could make significant casualties on our troops. Radar control system with vision-base target verification has been designed to achieve better accuracy of target detection by verifying the effect of metrological parameters for the accuracy of target acquisition. In that, the main focus was to develop a user interface, which is capable of efficiently indicating targets. The study was focused to discover the impact prediction and back-track extrapolation methods of radars, metrological effects on projectile calculation, variation of refractive index of air, and effect of Earth's rotation in determining the target. A raster map has been designed to show targets on screen. This raster map has been found very useful, and it was extensively used during the war. A GPS radar interface was also built, and real-time video taken by UAVs were incorporated to the system. A secure data networks have been developed to transmit real-time video.

Sri Lankan military had to undergo casualties and major setbacks due indirect enemy weapons. In fact, it was one of the most needed requirements for the Sri Lanka Army to improve techniques and devices to counter these enemy weapons. For this cause, Sri Lankan government invested a large amount of foreign exchange in recent times. However, the success was limited. Therefore, this development project was launched to augment the available AN/TPQ-36 weapon locating radar adding to it the features mentioned above. Effects of metrological data were acquired and applied to the artillery fire units and a significant improvement of accuracy was achieved for 122mm rocket and 130mm artillery. Refractive index variation of the atmosphere was calculated up to 20Km altitude and feed into the radar to improve accuracy of height calculation of the targets. Real-time videos of surveillance UAV were incorporate to the system so that artillery impact sites could have been identified accurately, without need of forward observation officers.

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NOMENCLATURE

Following symbols and abbreviations are used in this document

A/D	-	Angle of departure
ϕ	□-	Angle of elevation
BSU	-	Beam Steering Unit.
E1	-	2MB data stream
g	-	Gravitational force ($9.8ms^{-2}$)
Hv	-	Horizontal component of velocity
h	-	Projectile height at time t.
HV	-	High Voltage.
LSB	-	Lower Side Bit
MV	-	Muzzle velocity
m/s	-	Meters per second
P	-	Air pressure
R	-	Range to the level point
ToF	-	Time of flight to the level point
T	-	Any given time/ absolute temperature.
U	-	Humidity
Vv	-	Vertical component of velocity
WLR	-	Weapon Locating Radar
WLU	-	Weapon Location Unit.