Self Regulatory Automated System for Samson Family and Its Variants to Barricade the Intruders using Wireless Sensor Nodes

Deepali Virmani

***Abstract*: Wireless sensor networks play a vital role in military application to monitor the territory. Extracting real time information is the critical job in military. So in this paper a novel framework based on feedback mechanism is proposed. Proposed Automation System (AS) automates the Samson guns and its variants to barricade the movement of intruders. Proposed AS deals with identifying the intruder and triggering the guns automatically. The proposed AS is validated on two different scenarios and the results prove the effectiveness of proposed AS.**

***Index Terms*: Intrusion Detection, WSN, Fuzzy, Samson, Weapon Station.**

I. INTRODUCTION

A wireless sensor network (WSNs) is made up of thousands of spatially distributed autonomous sensor nodes which are used to collect information and supply the information towards the central node for further processing [1], [6]. An intrusion detection system is used to control network for malicious activities or dead nodes and reports to a management station [2], [3]. Although intrusion detection is an imperative issue to WSN [4], but it will be more beneficial if the complete system is automated using automatic guns and the data retrieved through sensor nodes. Guns or equipment have been developed by various countries which are automated or remote based like Samson guns, Sentry gun, etc. and are deployed in countries like Korea. There should be a mechanism that automatically makes the guns fire if any intrusion is detected by the WSNs. This paper proposes a novel framework which automates the defense system of the army at the international border. This framework uses the information retrieved from the processed data supplied by the sensor nodes to the cloud [5]. Automatic guns are capable of covering 1000m (approximately) of distance. The Samson Remote Controlled Weapon Station (RCWS), also known as Katlanitis a Remote Weapon System which enables a variety of devices to be operated automatically or by remote control, that includes 5.56 mm, 7.62 mm, and 12.7 mm machine guns, 40 mm automatic grenade launchers, anti-tank missiles and observation pods. The Samson family consists of three variants:

1) Samson Jr. ROWS –used for 5.56 mm and 7.62 mm machine guns, weighs 60–75 kg.
2) Mini Samson ROWS – used for 12.7 mm and 14.5 mm machine guns, as well as 40 mm grenade launcher, weighs 140–160 kg.
3) Standard Samson - used for guns with calibre ranging from 20–40 mm (0.79–1.57 in), weighs 1.5 tonnes.

These three variants of the Samson family will be deployed at the international border in fixed number and energy will be supplied by the WSN.

II. LITERATURE SURVEY

Automation of defense system have deployed in various regions of the world like North Korea, South Korea but they are detecting the intruders using camera which is not a very successful technique because they need to supply external energy every time and deployment of cameras is not secure. All previous work is about to deploy the sensor nodes near the international border and to retrieve the information from the data supplied by the sensor nodes.

In paper using sensor nodes, the guns will be commanded to fire at a particular time with a particular force. The given approach is to automate the system completely and to reduce manpower which may lead to less number of life losses.

III. PROPOSED APPROACH (AS: AUTOMATION SYSTEM)

Equal number of the three variants of Samson family (Samson Jr. ROWS, Mini Samson ROWS and Standard Samson) has been deployed at the international border. Standard Samson is used for the heavy intrusion, Mini Samson ROWS for the light weighted intrusion and Samson Jr. ROWS is used for the intrusion by the infantry. The AS has been divided into three stages:

1) Selection of Samson Variant.
2) Calculation of time.
3) Command to fire.

A. Stage 1: Selection of Samson Variant

This stage makes use of the impact factor (IF) that will be calculated by multiplying the average number (avg no) and the weight factor (WF):

IF = avg no * WF

Assignment of WF:

Classification of Intruders as per their weight:

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Deepali Virmani, Department of Computer Science Engineering, Bhagwan Parshuram Institute of Technology, Delhi, India.

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1) Infantry: <1700kg
2) Light Weighted: 1700-8000kg
3) Heavy Weighted : >8000kg

Weight factors are assigned to the intruders in table 2 [2], [3]:

Table 1: Weight Factors

Type	Heavy weighted	Light weighted	Infantry
Weight Factor(WF)	10	5	1

Table 2: Calculation of Impact Factor

	Name	Weight(kg)	Manufactured qty.	Avg no.	WF	IF
Heavy weighted						
	Leopard1	40200	348	72	10	720
	Leopard2	52000	450	225	10	2250
	M48	45600	1200	650	10	6500
	Jaguar	23200	543	25	10	250
Light weighted						
	Wiesel	1927	522	98	5	490
	MB1017	6800	7000	800	5	4000
Infantry						
	Soldiers	100		16	1	16

Now applying fuzzy logic on the input variables "Remaining energy" in the system and the "Impact factor" calculated above using mat lab, variant and the number of Samson guns will be finalized.

B. Stage 2: Calculation of time

This stage decides the accurate time at which the gun is to be commanded to fire so as to shoot at the target. This is the most important stage of the framework because appropriate timings will be the main thing to stop the intruder entering the international border.

This will be done by considering various factors:

1) Distance of the intruder from the sensor node.
2) Location of the sensor node.
3) Speed of the intruder.
4) Distance of the equipment from the sensor node.
5) Speed of the equipment.
6) Maximum distance travelled by the gun shot.

A location will be decided to shoot the target by comparing the maximum distance travelled by the gun shot. Time taken by the intruder will be calculated to reach the location by using formulas:

By comparing the timings of both the intruder and the gun shot to reach the location equipment will be commanded to fire.

$$Distance_{Location} = Distance_{Intruder} - Distance_{target} \quad (1)$$

$$Time_{Intruder} = \frac{Distance_{Location}}{speed_{Inrtuder}} \quad (2)$$

Time taken by the gun shot will be calculated to reach the location by using formulas:

$$Distance_{Location} = Distance_{target} + Distance_{Equipment} \quad (3)$$

$$Time_{Inruder} = \frac{Distance_{Intruder}}{Speed_{Equipment}} \quad (4)$$

By comparing the timings of both the intruder and the gun shot to reach the location equipment will be commanded to fire.

C. Stage 3: Command to fire

This stage will integrate the information of the two above stages and as per the requirement initiate the equipment to fire. This stage will follow the further algorithm:

1. Collect the data: remaining energy, type of equipment to be fired, number of guns to trigger.

2. Calculate energy required to trigger the guns by using formula:

Required $_{energy}$= energy required by the equipment to be fired*number of guns to trigger.

For type 1, energy_required = x units.

For type 2, energy_required = y units.

For type 3, energy_required = z units.

3. ifrequired_energy<remaining_energy, fire and set remaining_energy = remaining_energy – required_energy.

4. else check if external_supply_possible

if yes, energy_supply = required_energy – remaining_energy and command to fire.

else number of guns to trigger = remaining_energy / energy required by the equipment and command to fire.

Remaining $_{energy}$= remaining $_{energy}$– (number of guns to trigger * energy required by the equipment to be fired)

for(inti = 0; i< 3; i++)

if(type > 1 &&remaining_energy != 0)

type = type – 1;

$$\text{number of guns to trigger} = \frac{remaining_{energy}}{(\text{energy required by type} - 1)}$$

Fire 'a' number of guns equipment of type-1.

Remaining $_{energy}$= remaining $_{energy}$– number of guns to trigger * (energy required by type-1)

Algorithm : Command to fire

IV. CASE STUDY

Two case studies have been demonstrated to show the possible situations:

Case 1:

Remaining energy = 450 units

Samson variant required = Type 2(Mini Samson ROWS)

Quantity = 35

Required energy = 25 * 15 = 375units

Required energy < Remaining Energy

Command to fire.

Case 2:

Remaining energy = 450 units

Samson variant required = Type 3(Std. Samson ROWS)

Quantity = 40

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Required energy = 40 * 20 = 800units

Required energy > Remaining Energy

Remaining energy cannot satisfy the requirement.

External supply of energy is not possible.

As per the remaining energy 22 Std. Samson ROWS can be fired and the remaining energy will be 10 units.

Thus, with the given values 22 units of Std. Samson ROWS will be fired and 1unit of Samson Jr. will be fired and the remaining energy will be updated to 0units.

V. RESULT

Figure 1: Selection of Samson variant

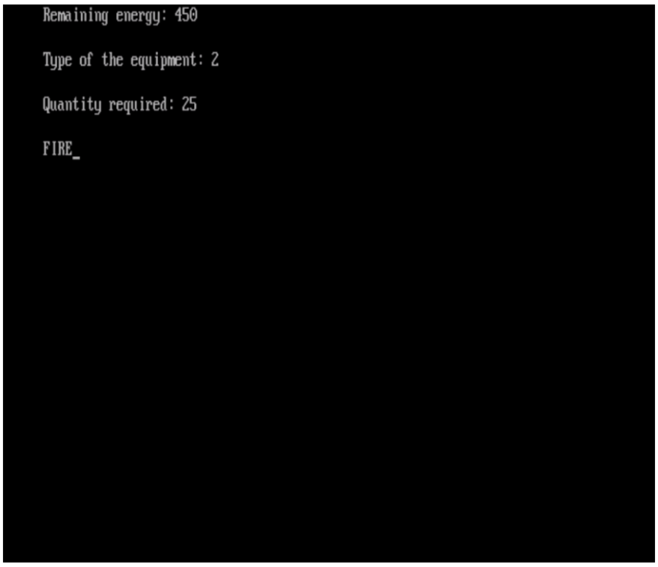

Figure 2: Result of Case 1

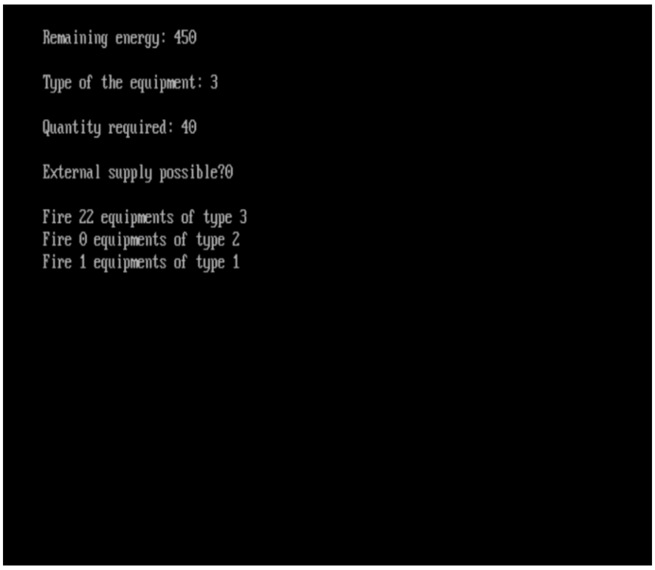

Figure 3: Result of Case 2.

VI. CONCLUSION

Intrusion detection is a critical subject in terms of combatting back and preventing the severity caused by intruders. The proposed AS provides an automated system consisting of Samson and its variant (Samson Jr ROWS, Samson Mini ROWS and Samson Std.) which are triggered by the sensor nodes. Unlike the surveillance cameras which are visible to the intruder, sensor nodes are grounded and thus less prone to attack. Over the traditional approaches of combating, the above automated system shows better results in terms of equipment automation and data security.

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AUTHORS PROFILE

Dr. Deepali Virmani has done, B. Tech, Computer Science from MDU, Rohtak in 2001, M. Tech in Information Technology in 2005, from GGSIPU and PhD Wireless Sensor Network from Delhi University in 2013. She has a teaching experience of 17 years. She is actively engaged in teaching and research in areas of Computer Science since 2001. She has published more than 73 research papers in International journals / National journals / International conferences of repute. Her research interests are in the areas of Sensor Networks, Data Mining and Security. She has guided more than 45 B.Tech projects. Presently she is guiding 5 PhD scholars registered with reputed universities like GGSIPU, UPTU. She is branch counselor BPIT -IEEE student chapter and BPIT-CSI student branch. She is on the reviewer panel / editorial board of many International Journals. She has organized many professional activities like FDPs, Workshops, expert lectures. She has been the session chair in National / International conferences.

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