Journal of Electronics, Electromedical Engineering, and Medical Informatics (JEEEMI)
Multidisciplinary: Rapid Review : Open Access Journal **eISSN: 2656-863**

RESEARCH ARTICLE OPEN ACCESS

Manuscript received November 8, 2020; revised December 14, 2020; accepted January 21, 2021; date of publication January 21, 2021

Digital Object Identifier (DOI): https://doi.org/10.35882/jeeemi.v3i1.7
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Optimization of Targeting Rocket Launchers with Wheeled Robots

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ABSTRACT The quick launch weapon system is unique. This rocket launcher has a high launch rate, but the rocket launched is one stage lower than the launcher normally launched by ships of this size. For example, a (medium) cruiser would use a fast light rocket launcher to launch a light (small) rocket. Currently rocket launchers are still controlled by humans, using PCs and servo motors as control tools to determine the accuracy of the shooting angle, so complete components are needed when designing the robot so that the robot can work automatically as needed. For the input given, Automatically control the rocket launcher robot and communicate via PC, then use a USB TTL cable to forward commands to the microcontroller, then send it to the Xbee-pro transmitter circuit, then send and receive by the Xbee-pro receiver, and then send the Microcontroller for transmitter control sent to servo and rocket motors in the transmitter control system in the form of a relay. Based on the test results, the robot can guide the rocket launcher at a predetermined angle, and can launch manual rockets, multiple rockets, triple rockets and all rockets, with a success rate of up to 80%.

INDEX TERMS: Rocket Launcher, Optimization, Servo Motor, Microcontroller

I. INTRODUCTION

In this era of technological development, the need for military equipment is increasing. This demand can be fulfilled through domestic production capacity [1]. This reduces the skill training required to use the weapon (since rocket skill requirements are based on ammunition type, not launcher size), and also causes unnatural damage to ships equipped with fast launchers. The disadvantages are that they have a relatively small clip size (19-30 frames) and very long reload times (35-40 seconds). This makes them very effective at destroying smaller foes quickly, but if the target does not die before being hit by a heavy object, it is inefficient in large battles, such as between a high rate of fire and a small magazine, a fast launcher. tired easily.

Time of taking pictures when reloading. This factor is the basis for the formulation of direction, focus and policies for the development, control and development of national defense and security technology, particularly weapons [2] - [3]. The development of science and technology in several developed countries has created robots to help improve the professionalism of their soldiers, such as "Bomb Squash Robot MOROLIPI [4] - [6]". The application of the mobile manipulator model to the bomb decomposition robot destroyed the 0.5 kg bomb [7].

With the rapid development of technology, especially in the field of electronics which is very important in the military field, military robots are very helpful in overcoming various situations and dangerous situations on the battlefield and on the battlefield. A place that is difficult for humans to reach. 8] - [9]. In this case, researchers are trying to develop a sprocket robot that can perform reconnaissance and long range strikes in the surgical area [10] to reduce the loss of personnel and material while performing tasks in the surgical area.

II. MATERIALS AND METHODS

A. The Diagram Block

This circuit functions as a receiver for data sent via the Xbee-pro transmitter module, receives the data then sends it to the ATMega 16 microcontroller, the XBee module interacts with the Arduino Uno board. The XBee connected to the Arduino development board will act as a receiver and communicate wirelessly with the other XBee modules, while the other XBee modules will be connected serially to the laptop using the resource management board. Therefore, let us further explore the method of using XBee for Arduino wireless communication. As we learned in the previous tutorial, the XBee module can act as a coordinator, router, or terminal device, but this module needs to be configured to run in the desired mode. Therefore, before using XBee modules with Arduino, we must use the XCTU software [11] to configure these modules. To connect the XBee module to a laptop, use a USB to serial converter or a specially designed browser board [12]. Just plug the XBee module into the power management board and connect it to the laptop with a USB cable. If there is no converter or browser board, the Arduino board can be used as a USB to serial device and can easily communicate with XBee and laptops [13]. Just upload the blank sketch to the Arduino development board, and it can now work like a USB to serial converter [14].

The circuit diagram shows the connection between the ZigBee module and the Arduino interface

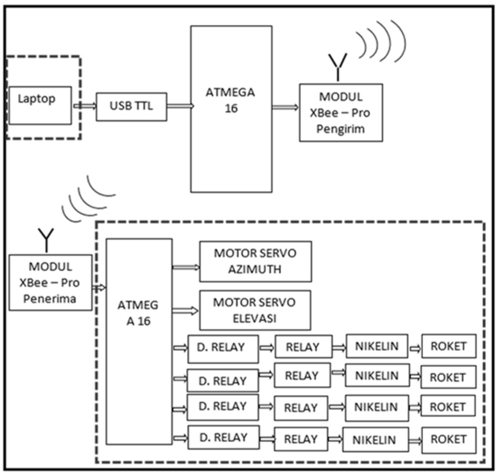

Fig. 1. Determining the Optimal Target Accuracy for a Wheeled Robot with a Rocket Launcher

Change the input voltage on the ATMega 16 microcontroller and send it back to the servo motor to drive the elevation and azimuth motors. The data inputted to the ATmega 16 microcontroller will be converted and sent to the relay driver, then entered into the nickel launch rocket according to the data sent by ATMega 16 [15].

Fig. 2. Robot Mechanical Design

B. The Flowchart

The process of activating the program by turning on the power then initializing the port that will be used on the system. If "No", the microcontroller detects command data or commands sent while waiting for input data; if "Yes", the microcontroller detects command data (if command data is received). The microcontroller gets data from the command data and then switches to the left direction command. If "Yes", the left motor is activated. If a command has been redirected to another command or there is no command, it will be closed, otherwise it will enter the correct direction command.

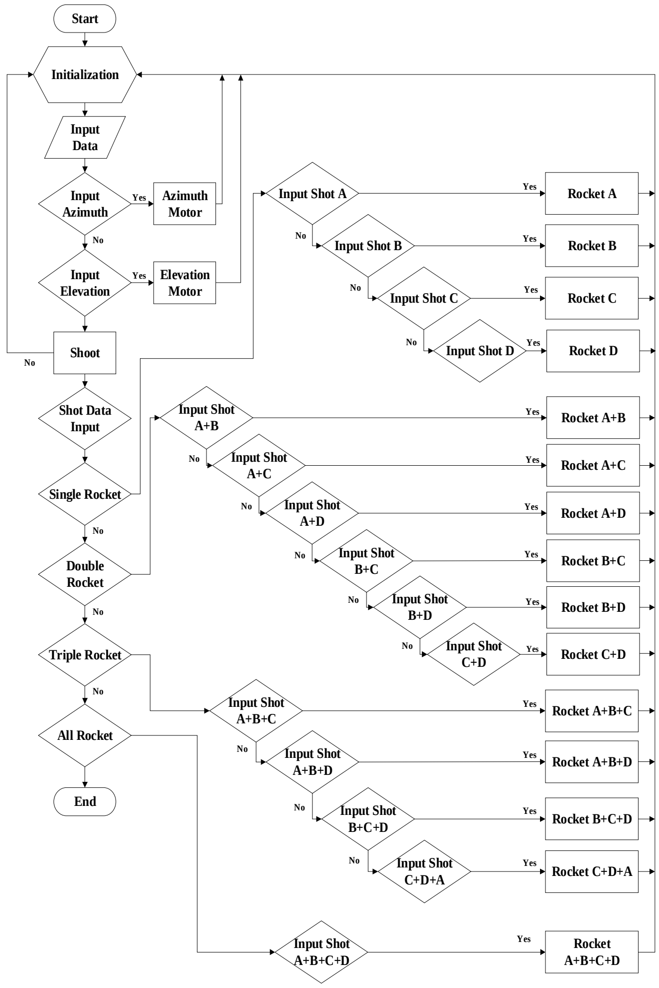

Figure 3. Flowchart of Wheeled Robot with Rocket Launcher

The microcontroller gets data from the left direction command to the elevation command. If "Yes", turn on the lifting motor. If a command has been transferred to another command or there is no command, the microcontroller will shut down; if "No", enter the next altitude prompt. The microcontroller obtains data from remote commands to low-range commands. If the low speed gear motor is activated as "Yes", or one command is moved to another, or no command is executed, the microcontroller will shut down; if "No", the command will continue. Instruct to start shooting. If the command is "yes", ignition is triggered, then the relay is activated, and a nickel wire is used to launch the rocket automatically. If a command has been redirected to another command or there is no command, it will be "No" and azimuth and elevation will stop. If the system is disabled, all processes on the microcontroller will stop.

C. Exploration

The device's operating system starts with a command sent by the laptop (PC), then sends it to the microcontroller, and then changes to Xbee-pro. Xbee-pro frequencies are sent from the Xbee-pro transmitter and received by the Xbee-Professional receiver. The function of the Exbee-pro is to convert the signal waves into a voltage that will be received by the microcontroller, then the microcontroller runs the program according to the required work system. Move the rocket launcher to azimuth and elevation to adjust the desired position, then activate the rocket.

When the button used as a switch is pressed, the trigger voltage will flow along with the microcontroller input voltage. Using the input voltage, the microcontroller will run a program command to activate the active low port PC4 (logic 0) and activate the active low port PC5 (logic 1). PB1 will activate PWM to enter the servo motor circuit. PWM is used to modulate the motion signal of the servo motor to move the elevation and azimuth angles. To take pictures, this will activate the microcontroller on ports PC0, PC1, PC2 and PC3.

III. RESULTS AND ANALYSIS

1) Pulse Testing Against Elevation Angle

Servo motors are used to test to determine the elevation angle, the input of which comes from the input pulse. And make a table of the results of the azimuth servo motor signal test, as shown in Table 1.

TABLE I.
TESTING OF PULSE AND ANGLE OF ELEVATION.

Pulses in M.K	Elevation Angle
500 ms	0°
600 ms	10°
700 ms	20°
800 ms	30°
900 ms	40°
1000 ms	50°

From the results of servo motor pulse testing shown in Table 1, it can be seen that the incoming pulse input will affect the angle. According to the experiment, the graph shown in Figure 4 can be obtained.

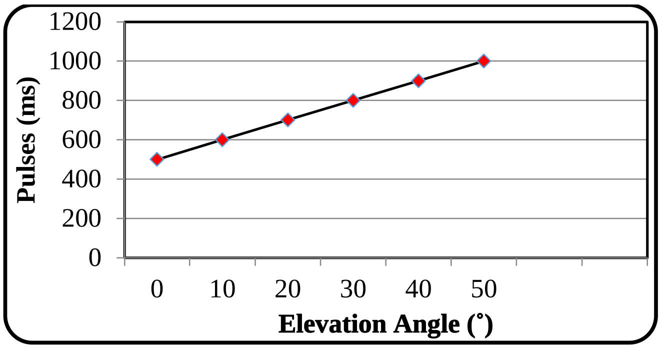

Fig. 4. Elevation Angle Pulse Graph

2) Pulse Test Results and Elevation Angle

TABLE II.
TESTING OF PULSE AND AVERAGE ANGLE OF ELEVATION.

Pulse	Pulse Test Results and Elevation Angle			
	Trial 1	Trial 2	Trial 3	Average
500 ms	0°	0°	0°	0°
600 ms	10°	10,1°	10,1°	10,067°
700 ms	20°	20°	20°	20°
800 ms	30°	30°	30°	30°
900 ms	40°	40,2°	40,1°	40,1°
1000 ms	50°	50°	50°	50°

From the servo motor test results and the elevation angle in Table II. The input pulses will then be compared with three tests and an average can be taken, so that the test graph is shown in Figure 5 as follows.

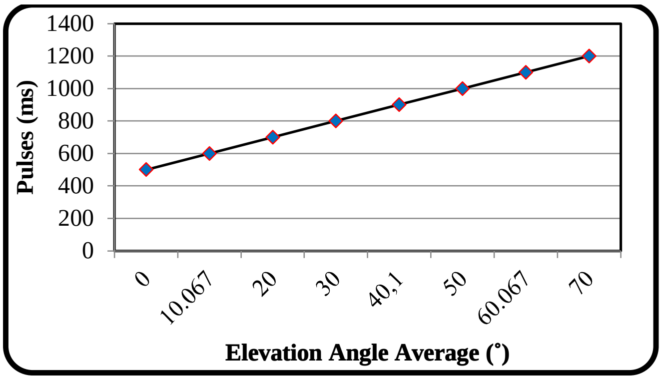

Fig. 5.Graph of Elevation Angle Pulse Testing

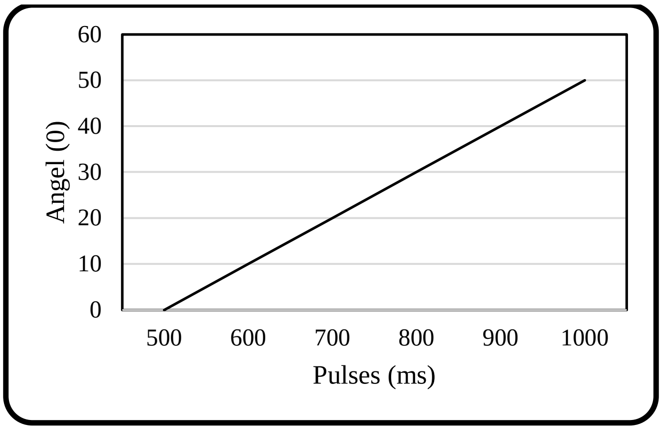

Fig. 6. Graph of Elevation Angle Pulse Testing #1

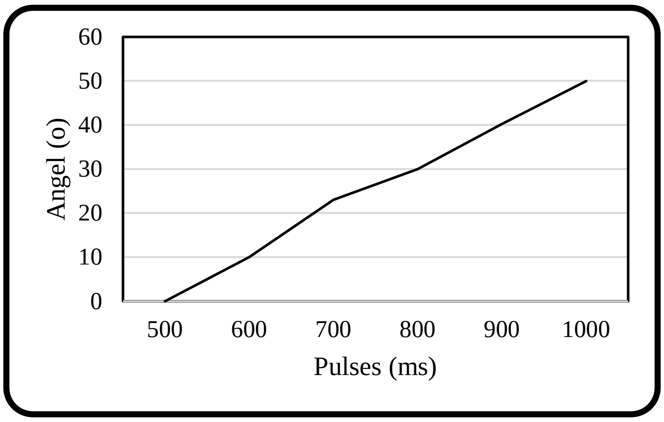

Fig. 7. Graph of Elevation Angle Pulse Testing #2

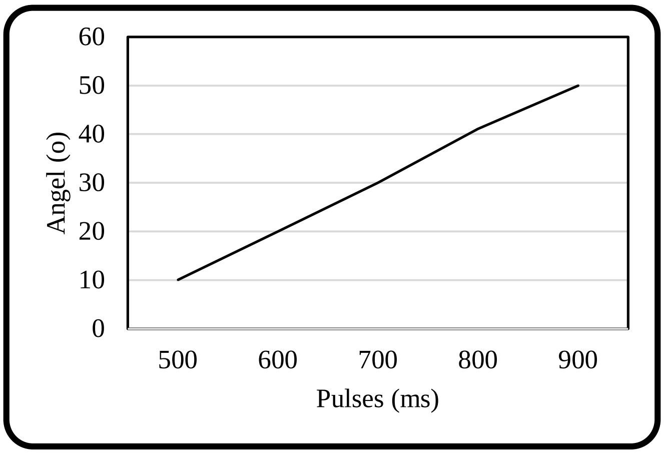

Fig. 8. Graph of Elevation Angle Pulse Testing #3

3) Pulse Testing Against Azimuth Angle

Testing using a servo motor is carried out to determine the azimuth angle whose input comes from the input pulse. The results of the servo azimuth motor signal testing can be seen in Table III.

TABLE III.
TESTING PULSE AND ANGLE OF AZIMUTH

Pulse in M.K (ms)	Azimuth Angel (^{o})
500	0
600	10
700	20
800	30
900	40
1000	50

From the test results it can be seen that the input originating from the input pulse will affect the magnitude of the resulting angle, the greater the pulse input, the greater the resulting angle is shown in Table III. To find out the magnitude of the change in azimuth angle that occurs, the experimental data is represented in a graphic on the pulse test shown in Figure 6.

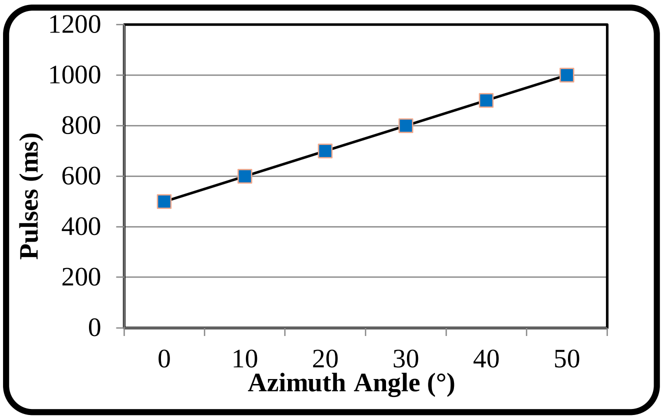

Figure 9 Azimuth Angle Pulse Graph

4) Test Results of Pulses and Azimuth Angle

TABLE IV.
TESTING PULSE AND AVERAGE ANGLE OF AZIMUTH..

Pulses in M.K (ms)	Azimuth Angle (°)			
	Trial 1	Trial 2	Trial 3	Average
500	0	0	0	0
600	10	10. 1	10.1	10.067
700	20	20	20	20
800	30	30	30	30
900	40	40.2	40.1	40.1
1000	50	50	50	50

From the servo motor test results for the azimuth angle with the input pulses then compared with three tests and the average can be taken as shown in Table IV. And the test graph is shown in Figure 7.

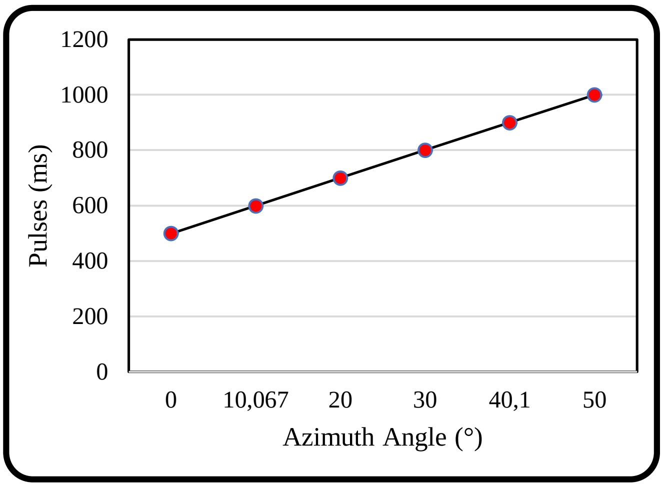

Figure 10. Graph of Azimuth Angle Pulse Testing

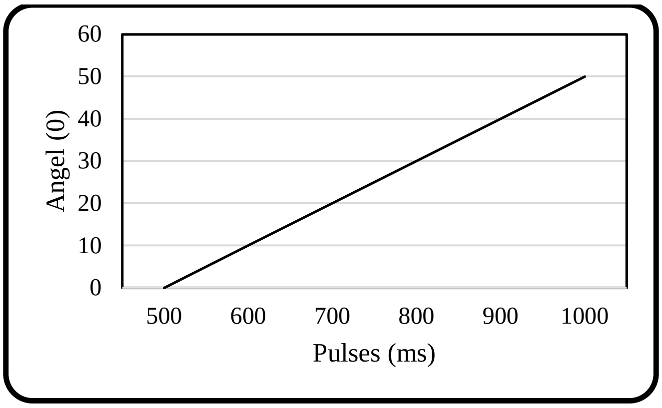

Figure 11. Graph of Elevation Angle Pulse Testing #1

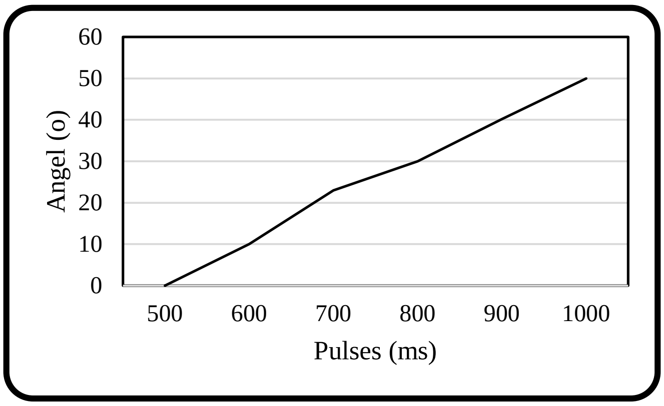

Figure 12. Graph of Elevation Angle Pulse Testing #2

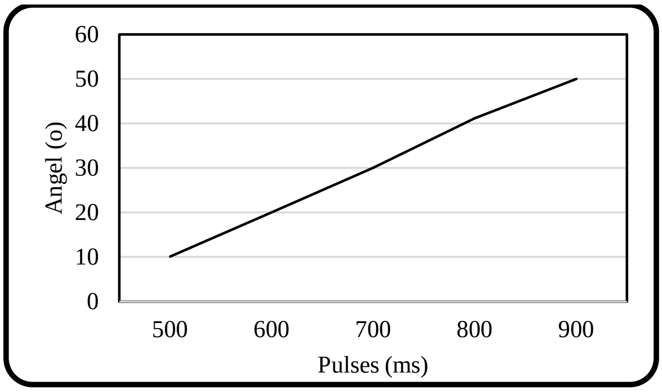

Figure 13. Graph of Elevation Angle Pulse Testing #3

IV. DISCUSSION

As well as accuracy, most applications require a servo motor, which is typically characterized by high torque, high speed, or small size. For the fuel balance valve, the requirements for the main motor are simple: they must withstand ignition. Extreme shocks and vibrations occur mainly in the first stage. in. Three minutes after ignition of the rocket stage, the thrust generated by the engine is approximately 440,000 kN, which will exert a large force on the nearby fuel decorative valve.

A rocket is ammunition that is fired by a rocket launcher. Unlike turret guns, rockets have the ability to track targets. The range of a rocket does not depend on the optimal distance and decay distance, but on flight speed and flight time. The rocket damage depends on the target speed and its characteristic radius, blast radius, blast speed and rocket speed. damage. Reduce the coefficient.

Compared to the turret weapons, rockets have a bit lower rate of fire and higher damage per hit. They also do not care wether the target is close or far away. The primary strength of rockets is that, assuming that the target is within range, a rocket will always "hit" its target, but the damage dealt will vary depending on the size and speed of the target. However, rocket launchers fire more slowly than turrets of a similar size, and rocket damage is delayed due to travel time, rather than being instantaneous [16].

When the engineering team started evaluating the components of the fuel balance valve, vibration testing caused damage to the electric motor. To minimize the point of failure, they switched from a brush motor to a brushless motor. In this case, the most important criteria are: Can the motor withstand these operating conditions? This means that the gearbox must be able to withstand the load, and the Hall effect sensor must remain intact. In short, failure is not allowed in this extreme operating environment. Looking for a motorcycle manufacturer that can stand the test, meet the engineers [17].

Rocket engines not only generate vibrations, they also generate heat. However, contrary to expectations, thermal management does not pose a particular challenge in this application. A lot of heat is emitted and reflected. Interestingly, the thermal problem he cites is low temperature rather than high temperature. For example, during the second operating phase, the engine may only start up briefly. The vehicle can then slide for up to 45 minutes before entering the second combustion phase. So far, the rocket has not been outside the cold atmosphere [18] [19].

To control costs and production schedules, our philosophy is to use as many stock components as possible. No extra effort is required to increase application stability - the development team only needs to order standard products. Engineers disclose the process of prototyping so that the required samples can be obtained immediately.

V. CONCLUSION

From this research, the following conclusions can be drawn: In general rockets are much simpler weapon system to use than turrets. But while a rocket can apply up to 100% of the Base Damage to a ship in some situations, damage is often reduced by two factors: a) If the target ship's speed exceeds the speed of the rocket explosion. It can be considered that this is a spaceship that can go beyond the explosion to some extent. b) If the signature radius of the target ship is smaller than explosion radius of the rocket. Think of this as a small ship flying through a large explosion and only being hit by a part of it. In other words, rocket weapons are best at doing damage to larger, slower targets at longer range. This is not to say that a pilot cannot kill small, fast targets with the right rockets, or that there are no short range rocket boats. Rather, the most common applications of launcher fitted ships tend to be as longer ranged, heavy damage weapons. The rocket launcher on the chain wheel robot can move at an elevation angle from 0^{o} - 70^{o} by being given a pulse on the 500 - 1200 HZ microcontroller program so that the rocket launcher can move according to the desired angle. Activating the firing of the weapon at the rocket launcher on the chain wheel robot so that the firing can work properly with the relay as the trigger for the fire.

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