SHREE SHANTI BHAGWATI SECCONDARY SCHOOL

DEPARTMENT OF COMPUTER ENGINEERING

A Project Report On

Gorkhe

Submitted By:

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ABSTRACT

This project aims to design and develop a projectile motion-based artillery or a mini missile launcher, integrating principles from physics, mathematics, and computer science. The system will utilize an Arduino microcontroller to control the launch mechanism, ensuring precise targeting and accurate projectile motion.

The turret will be equipped with sensors to measure initial velocity, range of projectile and angle of projection. These inputs will be processed using mathematics and physics models of projectile motion, incorporating equations of motion and trigonometric functions to predict the projectile's trajectory.

By leveraging computer algorithms, the system will dynamically adjust the launch parameters to hit the target accurately. The integration of real-time data processing and feedback loops will enhance the system's precision and reliability.

This project not only demonstrates the practical application of theoretical knowledge but also provides a platform for further exploration in automated targeting systems and robotics. The successful implementation of this project will showcase the synergy between physics, mathematics, and computer science in solving complex engineering challenges.

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1. INTRODUCTION

This project, named **Gorkhe**, aims to design and develop a projectile motion-based artillery system that integrates principles from physics, mathematics, and computer science. The system utilizes an Arduino microcontroller to control the launch mechanism, ensuring precise targeting and accurate projectile motion. By leveraging real-time data from sensors and applying mathematical models, the system dynamically adjusts launch parameters to hit the target accurately. This innovative approach demonstrates the practical application of theoretical knowledge and showcases the relationship between different scientific disciplines in solving complex engineering challenges.

The Gorkhe artillery system is designed to be cost-effective and accessible, with all necessary components readily available in Nepal at a low cost. The system's design incorporates mathematical models to calculate the projectile's trajectory, using equations of motion and trigonometric functions. The Arduino microcontroller processes sensor data and adjusts the launch parameters in real-time, enhancing the system's precision and reliability. This project not only provides an educational experience but also explores potential real-world applications in areas such as defense systems, disaster management, and scientific research.

1.3 Our Aims:

- **Show How Physics Works**: Use the principles of projectile motion to design a working prototype of artillery.
- **Use Math for Accuracy**: Apply math to calculate the path of the projectile and ensure it hits the target.
- **Automate with Technology**: Use an Arduino to control the launcher and make adjustments based on sensor data.
- **Solve Real Problems**: Develop problem-solving skills by tackling challenges related to projectile motion and automation.
- **Work as a Team**: Encourage teamwork and collaboration among project members.
- **Explore Practical Uses**: Look into real-world applications of the turret or target hitter in areas like robotics and defense.

2. PRINCIPLE USED

- The principle behind your projectile motion-based turret or target hitter project involves the integration of physics, mathematics, and computer science to achieve precise targeting and accurate projectile motion. Here's a breakdown of the key principles:
- **Physics:** The project relies on the principles of projectile motion, which describe the motion of an object thrown or projected into the air, subject to only the acceleration of gravity. The key factors include initial velocity, launch angle, and the effects of gravity. The equations of motion are used to predict the trajectory of the projectile, spring mass system and hook's law are also used for maintaining constant velocity..
- **Mathematics:** Mathematical models are used to calculate the trajectory of the projectile. The key equations include:
- The horizontal distance (R) is given by $R = {U_0}^2 \ \frac{\sin 2\theta}{g}$.
- **Computer Science:** An Arduino microcontroller is used to control the launch mechanism and process sensor data. Sensors measure initial velocity, launch angle, and environmental factors such as wind speed and direction. The microcontroller processes this data using algorithms to dynamically adjust the launch parameters for accurate targeting. Feedback loops are implemented to enhance precision and reliability.

By combining these principles, the system can accurately predict and adjust the projectile's trajectory to hit the target. This project demonstrates the practical application of theoretical knowledge and showcases the relation between physics, mathematics, and computer science in solving complex engineering challenges.

3. MATERIAL REQUIRED & ESTIMATED COSTING

The table below is the list of required materials while developing this project. This cost was estimated by taking Daraz as a reference with there prize ranze. The price below may vary according to the region. If any of the material is available in school at working condition the total price may get reduced.

S.N	Name of Material	Quantity	Price (Rs / pcs)
1	Arduino Uno / Arduino Nano	1	1,000 – 13,00
2	SG 90 Servo Motor	3	300 – 400
3	HC-SR04 ultrasonic sensor	1	200 - 400
4	Springs	4	10 - 30
	Total	9	2,140- 3,020

4. APPLICATION

The application of this project are explained below:-

Military Training Simulations: Use the system to simulate artillery fire for training purposes, helping soldiers practice targeting and firing techniques in a controlled environment.

Defense Systems: Implement the system in automated defense mechanisms to accurately target and neutralize threats, such as incoming missiles or enemy vehicles.

Scientific Research: Utilize the system in research projects to study the effects of different launch angles, velocities, and environmental factors on projectile motion.

Space Exploration: Adapt the system for launching small payloads or instruments into space, aiding in scientific experiments and data collection.

5. FEASIBILITY ANALYSIS

1. Team Experience: Two of the team members have previously participated in a Robbo race organized by Madan Bhandari Memorial College, gaining valuable experience in robotics and automation. Their hands-on experience will be instrumental in designing and developing the turret or target hitter, ensuring a higher likelihood of success.

2. Availability of Resources: The necessary components for the project, such as sensors, Arduino microcontrollers, and other electronic parts, are readily available in Nepal at a low cost. This accessibility ensures that the project can be completed within budget and without significant delays.

3. Educational Resources: Numerous tutorials and educational materials are available to guide the team through the project. These resources will provide step-by-step instructions, troubleshooting tips, and best practices, making the development process smoother and more efficient.

4. Technical Feasibility: The project involves integrating principles from physics, mathematics, and computer science, all of which are well-understood and can be effectively applied using an Arduino microcontroller. The team's existing knowledge and the availability of tutorials will help in overcoming any technical challenges.

5. Cost-Effectiveness: Given the low cost of parts and the team's existing experience, the project is cost-effective. The budget can be managed efficiently, ensuring that the project remains financially viable.

6. Time Management: With the team's prior experience and the availability of resources, the project can be completed within a reasonable timeframe. Proper planning and task allocation will ensure that the project stays on schedule.

7. Potential Challenges: While the project is feasible, potential challenges include ensuring precise targeting and dealing with environmental factors such as wind. However, these challenges can be mitigated through careful design, testing, and iteration.

6. OUR TEAM

Team Name: Tech BARSA

Team Members:

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Bikal Thapa	**Aashik Thapa**	**Ashis Subedi**
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Reeva Khadka	**Suman Timsina**	

7. CONCLUSION

Our project Gorkhe is highly feasible given the team's experience, availability of resources, and cost-effectiveness. With proper planning and execution, the project can be successfully completed, showcasing the practical application of physics, mathematics, and computer science.