HS202 PROJECT REPORT

Project Title:-" **SECURECYCLE**"

Group No. – 27

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HS202 Project Report

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TITLE

"SecureCycle: Your Shield Against Cycle Theft on Campus"

2.Abstract

"SecureCycle" is a comprehensive project aimed at addressing the persistent issue of cycle misplacement and theft within college campuses. The project aims to improve the safety and feasibility of bicycle travel for staff and students by utilizing a combined approach that includes innovative technology, community involvement, and affordable solutions. The creation of a specific smartphone application for tracking and registering bicycles, the use of barcode technology to effectively manage bicycle storage spaces, and working together to promote a responsible and aware culture are important elements. "SecureCycle" seeks to safeguard resources, maintain academic and professional responsibilities, encourage sustainable mobility, and improve the overall campus experience by simplifying present operations and fixing flaws in current security procedures.

3.Definition of the Problem

3.1 Problem Statement:

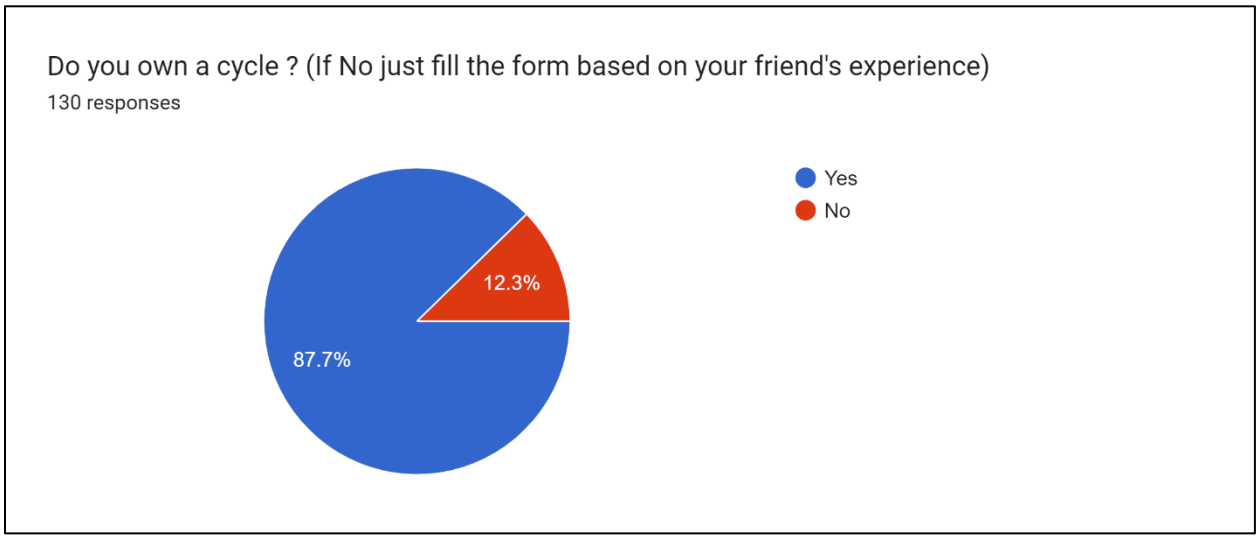
The prevalent issue of cycle misplacement and theft within our college campus poses a significant challenge, hindering the convenience and security of students and staff. Despite efforts to combat this problem, the occurrence persists, leading to financial losses and inconvenience for affected individuals. Therefore, our project aims to devise an effective solution to mitigate cycle misplacement and theft, enhancing the overall safety and convenience within our college campus.

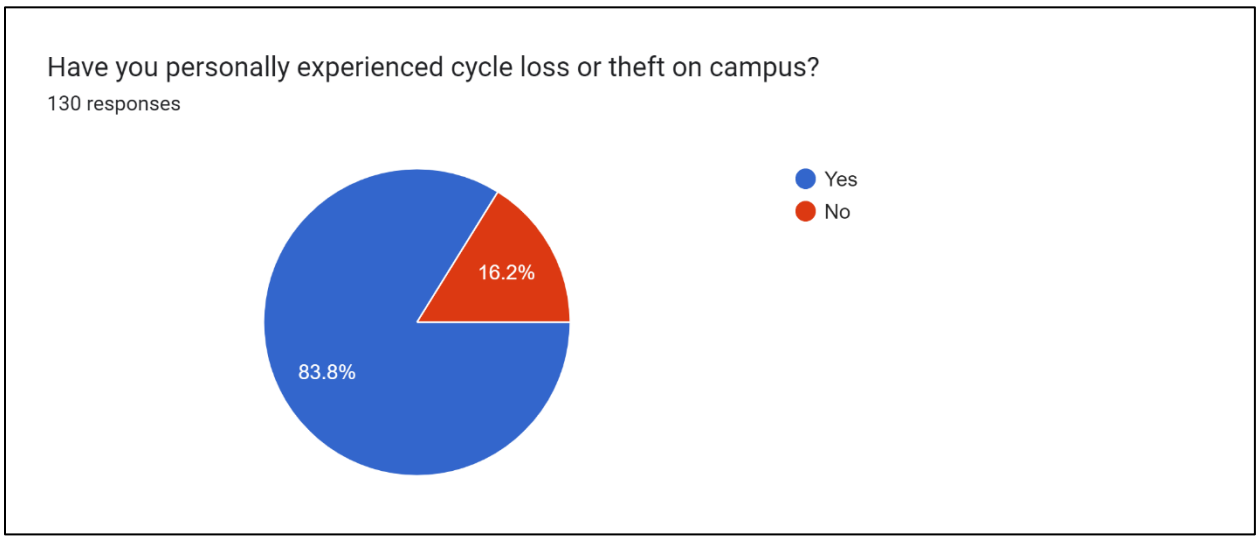
3.2 Origin of the Problem/Identification of the Problem:

To accurately identify the issue of cycle misplacement and theft within our college campus, a comprehensive methodology was employed. This included:

a). Surveys:

Surveys were conducted among the student and staff populations to gather quantitative data regarding their experiences and perceptions regarding cycle misplacement and theft. The surveys were designed to elicit specific information about the frequency of incidents, locations most prone to theft, the effectiveness of existing security measures, and suggestions for improvement.





b). Key Informant Interviews (KII):

Key informant interviews were conducted with individuals who possess in-depth knowledge and expertise related to campus security, such as security officers, campus maintenance staff, and administrative personnel. These interviews aimed to uncover hidden patterns, identify systemic weaknesses, and explore potential solutions from experts directly involved in addressing campus security concerns.

c). Focus Group Discussions (FGD):

Focus group discussions were organized with representative groups of students and staff to facilitate open dialogue and brainstorming sessions. FGDs encouraged participants to share their experiences, concerns, and suggestions collectively, fostering collaboration and generating diverse perspectives on the problem.

3.3 Detailed Description of the Identified Problem:

a). Frequency of Incidents:

- Cycle misplacement and theft occur with alarming regularity within our college campus, affecting both students and staff members.
- Numerous reports and complaints have been documented, indicating a pervasive problem that significantly impacts the daily lives of individuals relying on bicycles for transportation.

b). Vulnerable Locations:

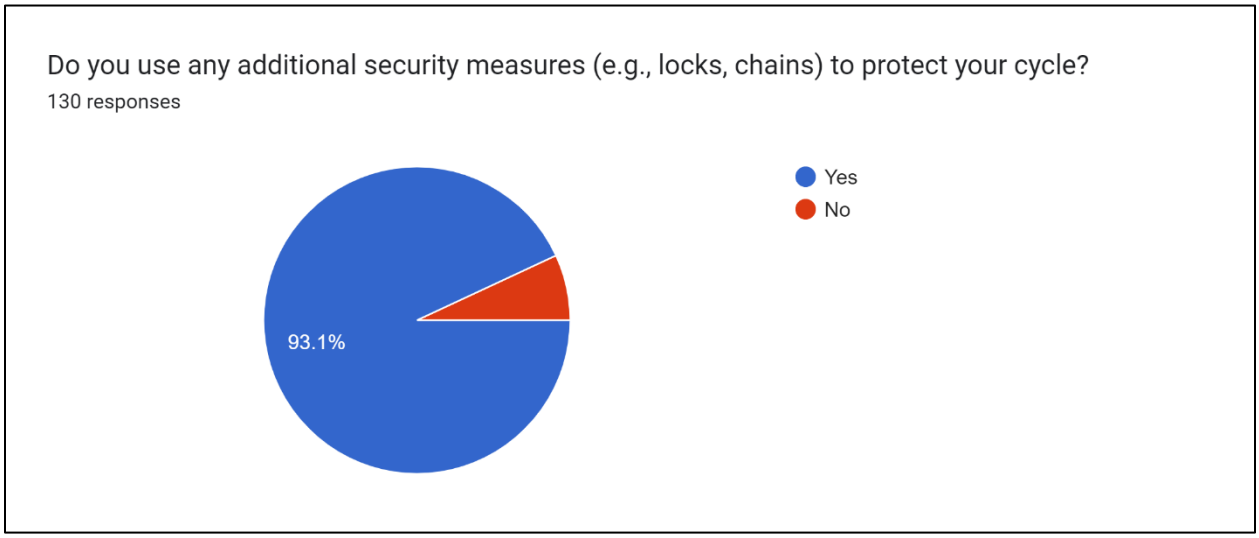
- Certain areas within the campus, such as bicycle racks near entrances or secluded spots, are particularly susceptible to theft and misplacement.
- Lack of adequate surveillance and security measures in these areas exacerbates the risk, providing opportunistic thieves with easy access to unattended bicycles.

c). Financial Losses and Inconvenience:

- Victims of cycle theft incur financial losses due to the high cost of bicycles and accessories, as well as the expenses associated with replacing stolen items.
- Moreover, the inconvenience caused by the sudden unavailability of transportation disrupts academic and professional commitments, leading to delays and added stress for affected individuals.

d). Ineffectiveness of Current Measures:

- Existing security measures, such as locks and surveillance cameras, have proven insufficient in deterring theft and preventing cycle misplacement.
- Despite efforts to raise awareness and implement preventative measures, the problem persists, indicating a need for more robust and proactive strategies.



3.4 Current Developments in the Domain:

a). Technology Integration:

- Advancements in surveillance technology, such as high-definition cameras, motion sensors, and smart locks, offer improved capabilities for monitoring and securing bicycle storage areas.
- Integration of GPS tracking systems and IoT (Internet of Things) devices enables real-time monitoring and tracking of bicycles, enhancing theft prevention and recovery efforts.

b). Community Engagement Initiatives:

- Collaborative efforts between students, staff, security personnel, and local law enforcement agencies are being emphasized to foster a sense of ownership and vigilance within the campus community.

c). Bicycle Registration and Identification:

- Increasingly, colleges and universities are implementing bicycle registration programs, where students and staff are encouraged or required to register their bicycles with campus authorities.
- Unique identification methods, such as engraving serial numbers or using RFID (Radio Frequency Identification) tags, are being utilized to deter theft and facilitate the identification and recovery of stolen bicycles.

d). Collaborative Partnerships:

- Collaborative partnerships between academic institutions and community organizations are facilitating the development and implementation of innovative solutions to address bicycle theft.

3.5 Need and Significance of Resolving the Problem:

a). Improved Security and Safety:

- Implementing a cost-effective solution to address the problem of cycle misplacement and theft within our college campus is imperative to enhance the overall security and safety of students and staff.
- By correcting the deficiency in the existing security measures, we can mitigate the risk of theft and create a safer environment for individuals relying on bicycles for transportation.

b). Protection of Assets:

- Bicycles represent valuable assets for students and staff, and the financial losses incurred due to theft can be significant.
- Resolving the problem not only safeguards these assets but also protects individuals from the financial burden associated with replacing stolen bicycles and accessories.

4. Aims/Objectives/Goals pertaining to minimizing/ removing the gap (Problem)

- To Develop a Comprehensive Bicycle Security System: Design and implement a multifaceted security system that addresses the root causes of cycle misplacement and theft within the college campus, integrating technological innovation, community engagement, and cost-effective solutions.

- To Enhance Campus Security Infrastructure: Improve the effectiveness of existing security measures by upgrading surveillance technology, implementing smart locks, and enhancing visibility and monitoring of bicycle storage areas to deter theft and enhance security.

- To Establish a Collaborative Community Approach: Foster a culture of vigilance and responsibility among students, staff, security personnel, and local law enforcement agencies through collaborative partnerships and community engagement initiatives, encouraging collective efforts to prevent cycle theft and promote campus safety.

5. Tools and techniques (Interventions) perceived to be effective for resolving the issue

1. Development of a Dedicated Mobile Application:

- Create a user-friendly mobile application specifically designed for bicycle registration and tracking.
- Features may include registration of bicycles with unique identifiers, GPS tracking functionality, reporting of theft or suspicious activities, and updates on security measures and best practices.
- The app should be accessible to both students and staff, with clear instructions and incentives for registration.

2. Implementation of Barcode Technology:

- Utilize barcode technology for efficient management of bicycle storage areas.
- Barcode scanners can be installed at designated entry and exit points of bicycle parking facilities to track the movement of bicycles.
- Barcode stickers or tags can be issued to registered bicycles for easy identification and verification.

3. Community Engagement Initiatives:

- Organize awareness campaigns and workshops to educate students and staff about the importance of bicycle security and theft prevention.
- Establish a campus-wide bicycle user group or committee to facilitate communication, share information, and address security concerns collectively.
- Encourage peer-to-peer accountability and reporting of suspicious activities through student and staff networks.

4. Bicycle Registration Program:

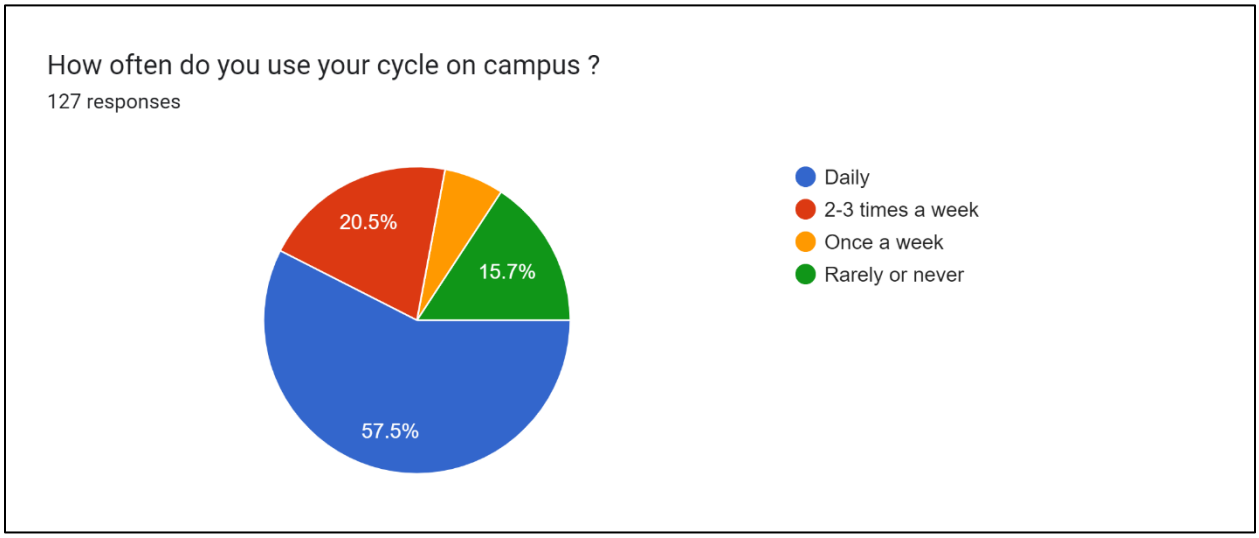
- Implement a mandatory or incentivized bicycle registration program to encourage students and staff to register their bicycles with campus authorities.
- Offer benefits such as discounted registration fees, priority parking, or insurance coverage for registered bicycles.
- Use unique identification methods such as engraving serial numbers or RFID tags to deter theft and facilitate recovery of stolen bicycles.

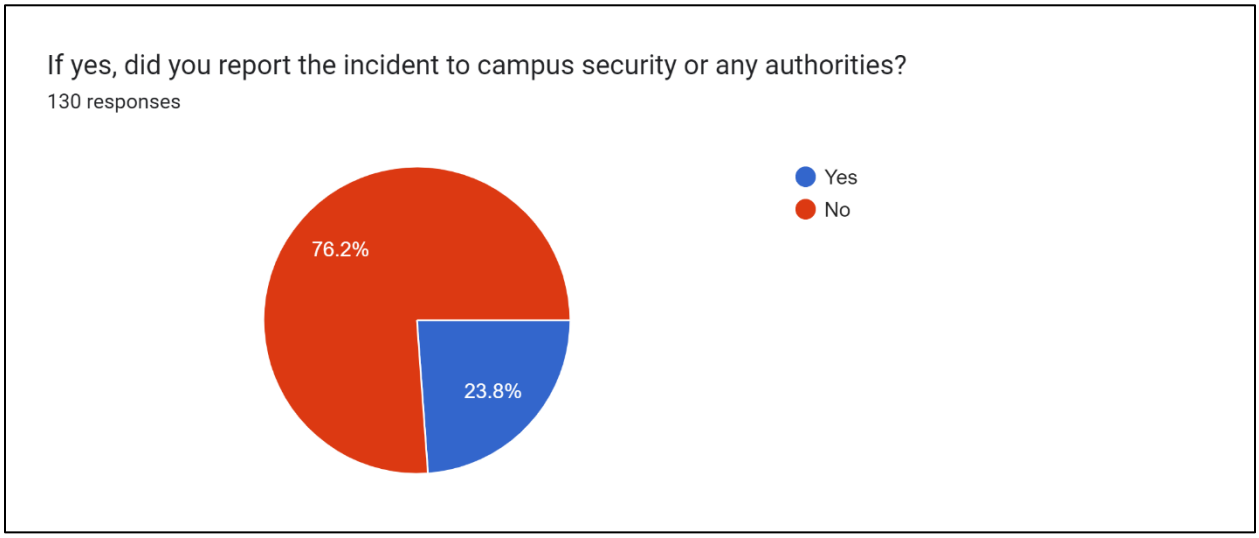
By integrating these tools and techniques into the "Secure Cycle" project, students can effectively address the issue of cycle misplacement and theft within college campuses, thereby enhancing security, preserving assets, promoting sustainable transportation, and improving the overall campus experience for students and staff.

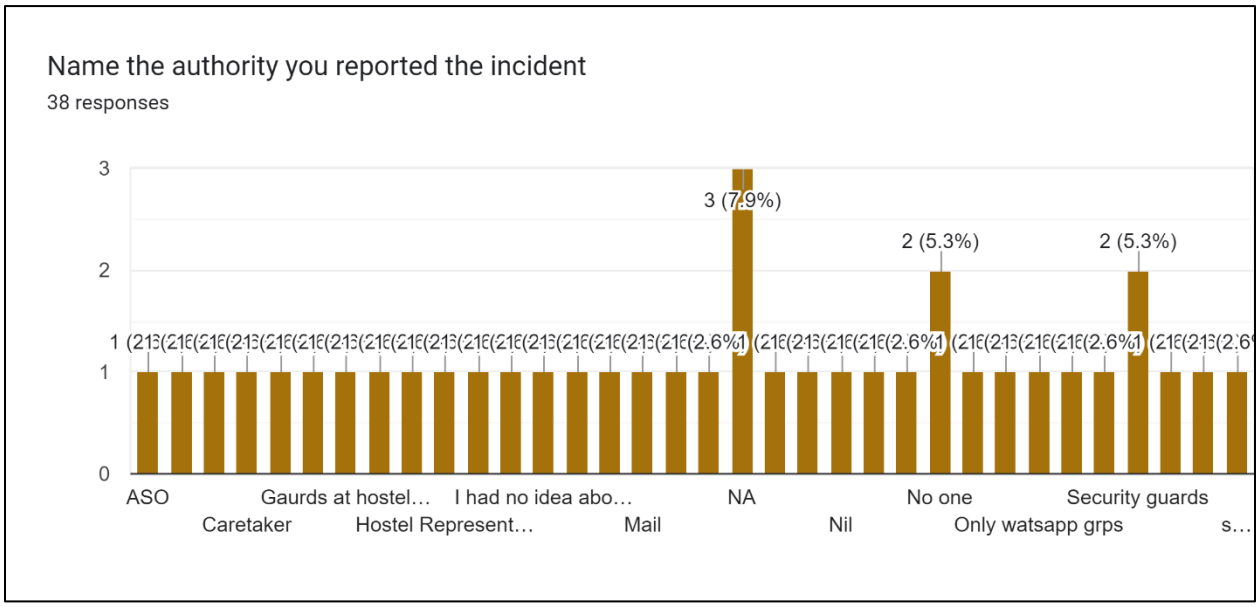
6. Detailed Work Plan/ technological interventions

Phase 1: Research and Analysis

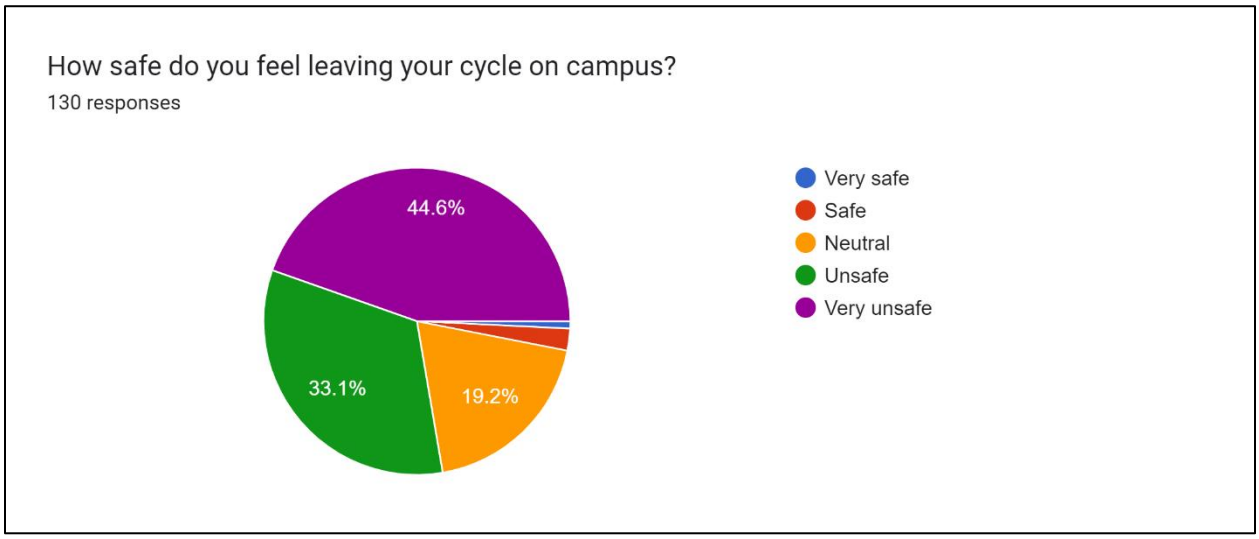
1. Gather Existing Data:
   - Collect data on past incidents of cycle misplacement and theft from campus security reports, incident logs, and student/staff complaints.
   - Analyze the frequency, locations, and patterns of these incidents to identify high-risk areas.





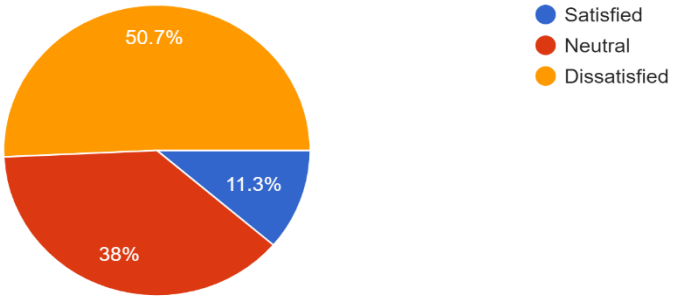


2. Students Engagement:
   - Conduct surveys, focus group discussions, and key informant interviews to gather insights from students, staff, security personnel, and administrative staff.



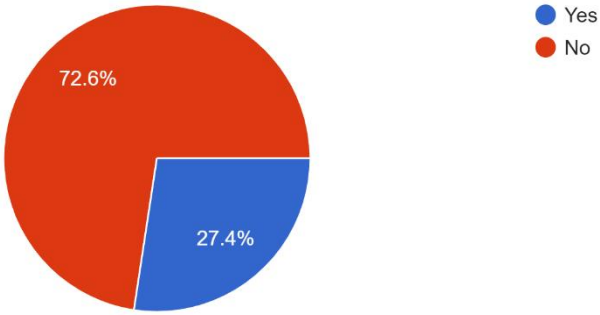
If you reported a cycle theft, how satisfied were you with the response and support from campus security?

71 responses



Did you got your cycle back after reporting the incident?

73 responses



How likely are you to consider purchasing a cycle with advanced security features, specifically designed to minimize the risk of theft or expedite recovery in case of loss?

130 responses

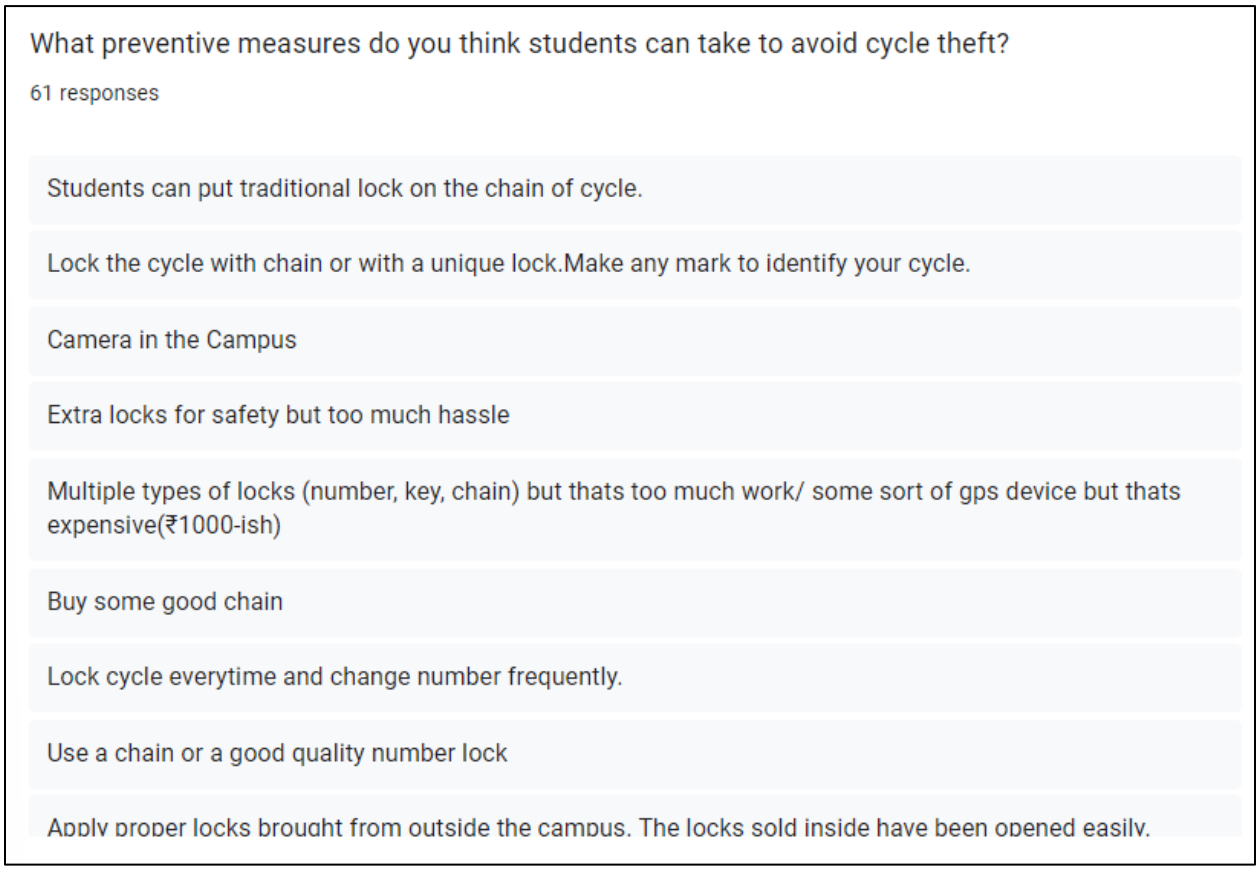


Figure 1 Suggestions by students

3. Technology Review:
   - Research existing technological solutions for bicycle security, including barcode technology, and mobile applications.
   - Evaluate the feasibility, cost-effectiveness, and suitability of these technologies for implementation within the campus environment

Phase 2: Solution Design and Development

1. Barcode Technology Implementation:
   - Integrate barcode technology for efficient management of bicycle storage areas.
   - Install barcode scanners at designated bicycle racks and storage facilities.
   - Develop a backend system to track bicycle movements and manage inventory using barcode data.

2. Mobile Application Development:
   - Design and develop a dedicated mobile application for bicycle registration and tracking.
   - Include features such as user registration, bicycle registration, theft reporting, bar-code scanner and notifications/alerts.
   - Ensure compatibility with iOS and Android platforms, as well as user-friendly interface design.

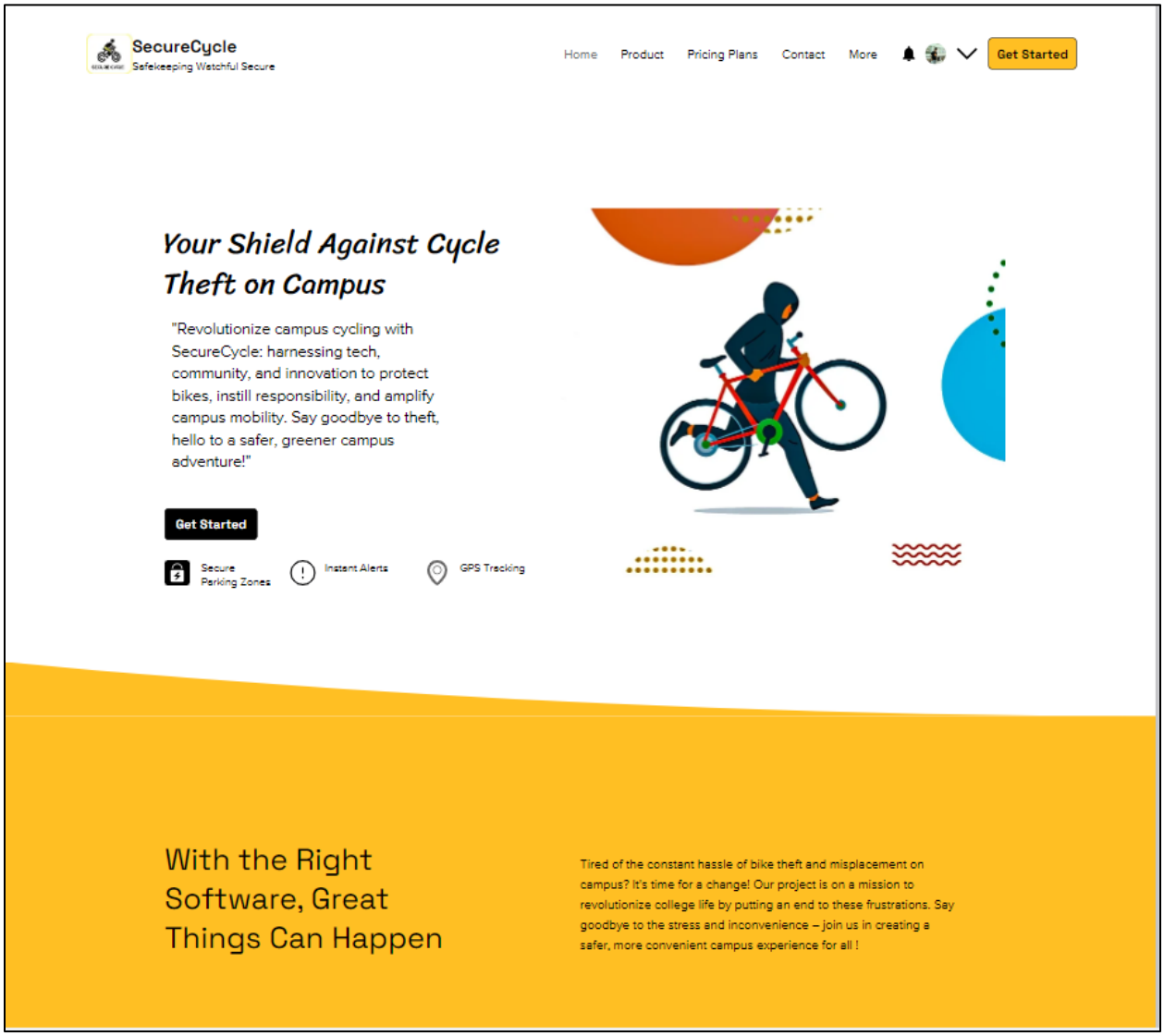


Figure 2 Secure Cycle Website

Figure 3 App Logo

Phase 3: Testing and Implementation

1. Deployment:
   - Select an area within the campus for initial implementation of the Secure Cycle solution.
   - Install necessary hardware, including barcode scanners.
2. Training and Awareness Campaigns:
   - Conduct training sessions for security personnel on using the Secure Cycle mobile application and bar -code monitoring systems.
   - Launch awareness campaigns to educate students and staff about the new bicycle security measures and the importance of registration and vigilance.

Phase 4: Evaluation and Iteration

1. Performance Evaluation:
   - Monitor the effectiveness of the Secure Cycle solution in reducing cycle misplacement and theft incidents.
   - Collect feedback from participants regarding user experience, system reliability, and security improvements.
2. Data Analysis and Optimization:
   - Analyze data collected from the mobile application and barcode scanners to identify trends and areas for improvement.
   - Use predictive modelling techniques to anticipate potential theft incidents and optimize security measures.
3. Iterative Development:
   - Iterate on the Secure Cycle solution based on feedback and evaluation results.
   - Implement updates, enhancements, and additional features to improve usability, security, and efficiency.

Phase 5: Full-Scale Implementation and Maintenance

1. Rollout Across Campus:
   - Expand the Secure Cycle solution to cover the entire campus, including all bicycle storage areas and facilities.
   - Ensure scalability and compatibility with the campus infrastructure and security protocols.

2. Ongoing Maintenance and Support:
   - Provide ongoing maintenance and technical support for the Secure Cycle system.
   - Regularly update the mobile application and backend systems to address security vulnerabilities and user feedback.
3. Community Engagement and Sustainability:
   - Maintain community engagement efforts to sustain awareness and participation in bicycle security initiatives.
   - Collaborate with campus organizations, student groups, and local authorities to promote a culture of vigilance and responsibility.

By following this detailed work plan and implementing the technological interventions outlined above, the Secure Cycle project aims to effectively address the problem of cycle misplacement and theft within the college campus, ultimately enhancing security, convenience, and sustainability for students and staff.

7. Cost Analysis:

The following would be included in the cost of creating a security feature for a cycle, such as a QR code:

- Technology Development: The price of creating the QR code technology, which includes integrating it with the cycle, guaranteeing security standards, and encoding user data.
- The cost of creating QR codes and printing them on robust materials appropriate for outdoor use on a bicycle.
- Ensuring data security procedures to prevent unwanted access or tampering with user information encoded in QR codes.
- Integration with Cycle Design: The price of smoothly incorporating the QR code into the cycle's design while taking durability, visibility, and placement into account.
- Testing and Quality Assurance: Costs associated with examining the QR code system for security flaws, usability issues, and functionality.
- Updating security methods and software are among the ongoing expenses associated with keeping the QR code system functional.

- Marketing and User Education: The price of informing users about the security feature and teaching them how to utilize it properly.
- Possible Legal and Compliance Costs: These include the price of adhering to data protection laws and any possible legal ramifications from the security feature.

8. Novelty/Innovation of the proposed intervention:

Introducing a QR code system to enhance security and prevent cycle theft is indeed an innovative approach. Here are some key novelty factors of this solution:

1. Personalized Identification: By including user information in the QR code, such as contact details or owner identification, the cycle becomes uniquely identifiable. This personalization adds a layer of accountability, making it less attractive for thieves as the risk of being caught increases.

2. Efficient Tracking: QR codes can be easily scanned using smartphones, allowing anyone who finds the cycle to quickly access the owner's information. This facilitates a faster and more efficient process for returning lost or stolen cycles to their rightful owners.

3. Data Accessibility: Storing user information in the QR code ensures that pertinent details are readily available to anyone who needs them. This eliminates the need for manual registration or searching through databases, streamlining the process of reporting lost or found cycles.

4. Deterrent to Theft: The presence of a QR code prominently displayed on the cycle serves as a visible deterrent to potential thieves. Knowing that the cycle is easily traceable and linked to its owner may dissuade individuals from attempting to steal it in the first place.

5. Customizable Security Features: QR codes can be designed to contain various layers of security, such as encryption or password protection, to prevent unauthorized access to sensitive user information. This ensures that the system remains secure and protects user privacy.

6. Community Engagement: Implementing a QR code system for cycle security encourages community involvement in the prevention of theft and the recovery of lost items. People are more likely to help return a cycle if they can easily identify its owner through a simple scan.

7. Scalability and Accessibility: QR code technology is widely accessible and can be implemented on a large scale with relatively low cost and effort. This makes it an ideal solution for enhancing cycle security in various environments, from urban areas to college campuses and beyond.

9. Approaches that can be taken to implement intervention plans

Here are some practical approaches that can be taken to implement the proposed intervention plans, suitable for a team:

1. QR Code Generation System Development:

- Approach: Utilize programming skills to develop a web-based or mobile application that allows users to input their information and generates a personalized QR code.
- Tools: Use programming languages like Python, JavaScript, or Java along with libraries/frameworks such as Flask, Django, React, or Angular.
- Resources: Online tutorials, documentation, and forums for learning and troubleshooting.

2. User Education Campaign:

- Approach: Organize workshops, seminars, or informational sessions to educate users about the QR code system and its benefits.
- Tools: Presentation software (e.g., PowerPoint, Google Slides), communication tools for scheduling and coordinating events.
- Resources: Educational materials (e.g., slides, handouts) explaining the QR code system, online resources on effective presentation techniques.

3.Community Outreach:

- Approach: Collaborate with local organizations, schools, and businesses to raise awareness about the QR code system and encourage participation.
- Tools: Social media platforms, email newsletters, flyers/posters for promoting events and initiatives.

- Resources: Networking opportunities with local community leaders and organizations, guidance on effective community engagement strategies.

4. Monitoring and Evaluation:

- Approach: Implement a system for monitoring the effectiveness of the QR code system in reducing cycle theft and facilitating cycle retrieval.
- Tools: Data collection tools (e.g., surveys, forms), spreadsheets or databases for organizing and analyzing data.
- Resources: Guidance on designing surveys and collecting feedback, resources on data analysis techniques.

5. Sustainability and Scalability Planning:

- Approach: Develop a sustainable funding model and explore opportunities for expanding the intervention to other communities.
- Tools: Business planning tools (e.g., Business Model Canvas), research on funding sources and scalability strategies.
- Resources: Guidance on business planning and sustainability, case studies of successful community initiatives.

10. Possible constraints and barriers to implementation, design issues:

Here some possible constraints and barriers are mentioned that can be faced by development team while implementing and designing:

1. Technical Expertise:

- Constraint: Limited knowledge and experience in software development, graphic design, and project management may hinder the successful implementation of the QR code system.
- Barrier: Difficulty in understanding and implementing complex programming concepts or design principles required for developing the QR code generation system and designing labels.

2. Resource Limitations:

- Constraint: Limited access to necessary resources such as computers, printers, and software tools may restrict the team's ability to execute certain tasks effectively.

- Barrier: Insufficient funds to purchase required materials (e.g., adhesive labels, printing supplies) or access premium software tools necessary for project implementation.

3. User Engagement:

- Constraint: Difficulty in engaging users and raising awareness about the QR code system may result in low participation rates and limited adoption.
- Barrier: Resistance from cyclists or community members regarding the effectiveness or value of the intervention may hinder acceptance and cooperation.

4. Technical Challenges:

- Constraint: Technical issues such as compatibility problems, bugs, or errors in the QR code generation system or label design software may arise during development.
- Barrier: Inadequate troubleshooting skills or lack of access to technical support resources may prolong the resolution of technical challenges, delaying project progress.

5. Privacy and Security Concerns:

- Constraint: Addressing privacy and security concerns related to storing and sharing user information within QR codes may require compliance with data protection regulations.
- Barrier: Ensuring the confidentiality and integrity of user data, as well as implementing appropriate encryption or authentication measures, may pose significant design and implementation challenges.

6. Sustainability Planning:

- Constraint: Limited experience in business planning and sustainability strategies may impede the development of a viable funding model or scalability plan for the intervention.
- Barrier: Uncertainty about long-term funding sources or the scalability of the intervention beyond the initial implementation phase may hinder its sustainability and impact.

11. Expertise available with each student to contribute to the development of intervention:

We have some common expertise like technical expertise, collaborative abilities, and interdisciplinary skills. Below we have mentioned what expertise the individuals have:

1. Mechanical Engineering Skills:

- **Design and Prototyping**: Proficiency in CAD (Computer-Aided Design) software to design the physical components of the QR code labels, such as their size, shape, and mounting mechanism.
- **Materials Selection**: Knowledge of materials science to choose appropriate materials for the QR code labels, considering factors such as durability, weather resistance, and cost-effectiveness.
- **Manufacturing Processes**: Understanding of manufacturing processes such as 3D printing, laser cutting, or injection molding to produce prototypes or small-scale batches of QR code labels.
- **Mechanical Systems Integration:** Ability to integrate the QR code labels with bicycles in a way that ensures durability, functionality, and aesthetic appeal.

2. Software Development Skills:

- **Programming:** Basic programming skills to contribute to the development of the QR code generation system, using languages such as Python, C++.
- **Web Development**: Familiarity with web development frameworks (e.g., Flask) to create a user-friendly interface for generating QR codes and managing user data.
- **Database Management**: Understanding of database management systems (e.g., SQL) to store and retrieve user information securely.
- **User Interface (UI) Design**: Knowledge of UI design principles to create intuitive and visually appealing interfaces for the QR code generation system.

3. Project Management and Coordination:

- **Communication Skills:** Effective communication skills to facilitate collaboration within the group and coordinate tasks, deadlines, and deliverables.
- **Time Management:** Ability to prioritize tasks, set realistic timelines, and manage project resources efficiently to ensure timely completion of project milestones.

- **Documentation:** Skills in documenting project progress, including design iterations, technical specifications, and implementation details, to facilitate knowledge sharing and future iterations.

4. Problem-Solving and Innovation:

- **Critical Thinking:** Ability to analyse complex problems, identify potential solutions, and evaluate their feasibility and effectiveness.
- **Creativity:** Capacity to think outside the box and propose innovative ideas or design enhancements to improve the QR code intervention.
- **Adaptability:** Willingness to adapt to unforeseen challenges or changes in project requirements and devise creative solutions to overcome obstacles.

12. Expected Outcomes:

The successful implementation of our proposed solution is anticipated to yield several positive outcomes, impacting various aspects of campus life and student experiences.

12.1 Reduction in Cycle Theft and Loss Incidents:

- We hope that the mobile application's integration with QR code/bar code technology will result in a noticeable decrease in the number of bike theft and loss events reported on campus.
- Potential thieves will be prevented by the increased visibility and traceability provided by the QR codes/bar codes, which will also speed up the recovery of stolen or lost cycles.

12.2 Improved Student Satisfaction and Confidence:

- It is expected that the installation of effective cycle security measures and better response to incidents will greatly increase student satisfaction with campus security services.
- Our solution will make campus life more enjoyable for students and build a sense of trust and security among the student body by giving them more peace of mind and confidence over the safety of their things.

12.3 Financial Savings and Security:

- Students will experience real financial savings because of preventing and minimizing the impact of cycle theft and loss situations, since they won't have to pay for the replacement of stolen or lost cycles.
- Students' worry and anxiety will be reduced by their newfound financial security, free up money for other personal and educational requirements and improving their general wellbeing and academic achievement.

13. Suggested Plan of Action for Utilization of Outcome Expected from the Work:

To ensure the effective utilization of the outcomes expected from our work, we offer a thorough action plan that includes several aspects of capacity building, cooperation, sustainability, and monitoring.

13.1 Continuous Monitoring and Evaluation:

Optimizing resource allocation and finding areas for improvement need for the creation of a systematic framework for tracking and assessing the impact and efficiency of the implemented solution.
Regular evaluations and data gathering will offer insightful information about the functionality and long-term viability of the mobile application and QR code/bar code system.

13.2 Collaboration and Knowledge Sharing:

Forming connections with campus the authorities, security guards, student associations, and nearby partners will allow us to take advantage of a variety of networks, resources, and specialized knowledge to effectively combat cycle theft and loss.

13.3 Sustainability and Capacity Building:

Long-term sustainability and impact can be assured by creating training materials, guidelines, and support resources that will make it easier to use and maintain the mobile application and QR code/bar code system.

14. Conclusion:

In summary, our approach presents belief for lowering cycle theft and loss at IIT Ropar, increasing everyone's safety on campus.
Through data analysis and student interviews, we have put a lot of effort into understanding the issue. We have developed workable ways to enhance bicycle security and assist students in recovering their stolen bikes by utilizing QR code/bar code technology and a smartphone app.
However, solving the issue at hand is not the only goal. Our goal is to establish a culture where everyone takes ownership in maintaining the safety of our campus. This entails cooperating with security, students, and university administrators, among others. We shall monitor the effectiveness of our solutions as we proceed. We are open to receiving input and will adjust as necessary to ensure that the IIT

Ropar community continues to gain from our efforts.
Together, we have demonstrated how creativity and collaboration can improve campus safety. We shall monitor the success rate of our solutions as we proceed. In order to ensure that our efforts continue to benefit the IIT Ropar community, we will pay attention to input and make necessary adjustments.

15. Contribution of Each Student of the Group to Complete the Assignment:

Each member of our project team has played a vital role in the development and execution of our intervention plan, contributing their unique skills, expertise, and insights to the project's success.

Task	Team Member	Details
Collecting and Analyzing Data	Priyanshu Singh	Conducted surveys, interviews, and data analysis to understand the problem of cycle theft and loss at IIT Ropar. Gathered essential information through various means to comprehend the scope and nature of the issue.
Planning Solutions	Priyanshu Rao	Oversaw operational and planning activities and developed plans to prevent cycle theft and loss. Created the implementation strategy, which included using mobile apps and QR codes to make sure the suggested solutions work.
Writing Reports and Making Presentations	Rahul Yadav	In responsible of writing thorough reports and giving convincing talks to convey results and suggested changes. Made certain that the information was understandable and available to all those involved.
Researching the Problem	Rajeev Kumar	Performed extensive research on the topic, looking at examples from similar situations, reviewing data, and reading relevant articles. Gave insightful information about the underlying causes of cycle theft and loss as well as possible solutions.