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| **Project Title:**  SafeCyclePath: Smart Safety Navigation for Cyclists & Pedestrian |
| **Project Summary:**  We are developing SafeCyclePath, a smartphone app offering safety-focused navigation for cyclists and pedestrians. While standard map software provides speed- or distance-optimised routes, SafeCyclePath uses numerous data streams, including crime statistics, accident records, infrastructure integrity, user reporting of dangers and real-time environmental data, to assign a safety index to every road segment. This index determines recommended routes, enabling users to select the safest route in their area and match users who live in the same neighbourhood and take similar routes at similar times, allowing them to connect, chat and commute together for safety, motivation and social benefits.  Walking or cycling through cities offers numerous advantages such as being green, cheap and healthy. Notwithstanding, safety becomes an essential issue to most commuters as it causes:   * Hotspots and dark streets, both of which put people in danger at nighttime; * Infrastructural gaps, potholes and hazardous traffic interactions, and they pose increased risks to cyclists.   Current navigation systems (like Google Maps, Waze and Strava) do not take note of safety information, compromising passenger safety. Target Users:  * **Students & young commuters**: Who tend to walk or cycle to save money, and enjoy the convenience of locating fellow commuters from university or their area. * **International residents & visitors:** who do not always know the local “safe” vs. “unsafe” areas and become more confident traveling solo when they join others traveling the same routes. * **Daily urban commuters**: cyclists and walkers aiming to avoid crowded public transport and to travel in greater safety with others for companionship, and comfort in numbers. * **Local councils & planners**: who can combine hazard data with public commentary to enhance safety and infrastructure of emerging communities. * **Community-oriented users:** the philosophy of “No one walks or cycles alone” and the Find a Mate feature allows users to plan safer journeys with others in the same area.  Use Case 1 **Scenario: A TU Dublin student walking from the Grangegorman campus to the Parnell Luas stop in the evening (Not Accurate Imaginary).**   1. The student opens the SafeCyclePath app and fills in the ‘going to’ field. 2. The app generates and suggests two route options: Fastest and Safest.    1. The Fastest route is about 10 minutes.    2. The Safest is 12 minutes with only 2 minutes longer. 3. The student’s map shows that the fastest route takes the student through a number of poorly lit side streets and an area marked as a unsafe hotspot. 4. The student chooses the Safest Route which is likely the better route as it along better lit streets which has high pedestrian traffic and many crosswalks. 5. During the student journey, real-time alert pops up from the map: Roadworks reported near Bolton Street, rerouting suggested. 6. The student arrived safely at the Parnell Luas stop and he/she reports a broken streetlight, improving safety data for future users.  Use Case 2 **Scenario**: **It is a young employee living in Sandyford who cycles daily from home by bike to the Leopardstown Business Park. Although the distance is not significant (about 3 km), part of the route involves busy junctions (e.g., Leopardstown Road) and intervals without separated cycle facilities.**   1. The rider launches the SafeCyclePath app the next morning and enters the destination: Leopardstown Business Park. 2. Prior to the development of the route, the app\_requested: "Would you like to find cycling companions nearby?" 3. The cyclist enables **Find a mate** and sees: "2 other passengers from Sandyford heading for Leopardstown around 8:30 am." 4. The app also shows both options:    1. Fastest Route (12 min): Sandyford Road route (wider intervals between cycle routes, more traffic).    2. Safest Route (14 min): cycle through Leopardstown Park, avoiding busiest junctions. 5. The rider takes the Safest Route and participates as part of a small group ride with two other users, which appears on the in-app map. 6. Along the way, the app shows a real-time message: "Accident on Sandyford Road, your group has been diverted through Kilgobbin Road." 7. The team arrives safely at Leopardstown as a group, and one member reports a hazard for a pothole on Drummartin Link Road, which bolsters later recommendations. |
| **Project Development:**  **System Architecture**  Our system will use a simple web setup where the part that users interact with is separated from the backend that handles all the data and calculations. On the user side, the website will be built using React.js so it works well on both computers and phones. The main feature will be a map, using tools like Leaflet.js or Mapbox, which shows routes and safety information. There will also be a section with different route options so users can pick the one they like. Users can use sliders to decide whether safety or speed is more important for their route. Simple forms will allow them to provide feedback or report any dangerous spots they notice.  On the server side, we plan to use Flask or Django to create an API that handles all the route calculations. Map and location data will be stored in PostgreSQL with PostGIS, which is good for handling geographic information. Python libraries such as NetworkX and OSMnx will be used to calculate routes, and a simple machine learning model using scikit-learn will give routes a safety score based on crime and accident data. Redis will be used to store some data temporarily to make the website faster. Users will be able to create accounts to save their preferences.  **Data Sources**  The system will get data from several sources. Crime data will be collected from the NYPD API to know where incidents occur. Street and road information will come from OpenStreetMap through OSMnx, and car accident records will be gathered from NYC open datasets. Users will also be able to submit hazard reports directly through the app. Weather data will be used because conditions like rain or snow can make certain routes more risky.  **Development Methodology**  We will follow the SCRUM development methodology with two-week sprints. In the first two sprints, we will set up the development environment and database, process NYPD data, and build a simple shortest-path routing algorithm. Sprints three and four will focus on creating a crime-based safety scoring model, building the React frontend with map integration, and adding a route comparison feature. In sprints five and six, we will deploy the minimum viable product (MVP) to a staging environment, test the algorithm using historical NYC safety data, and add monitoring tools to check performance.  The SCRUM team will include a Product Owner who defines what users need and sets acceptance criteria, a Scrum Master who helps the team and removes problems, and a development team made up of full-stack developers and data scientists. Key meetings will include daily standups of 15 minutes, sprint planning of 4 hours at the start of each sprint, sprint reviews and retrospectives lasting 2 hours each, and ongoing backlog refinement.  **Success Criteria for MVP**  The MVP will be considered successful if it processes 95% of Manhattan route requests successfully, maintains an average response time under three seconds, achieves at least 70% user satisfaction, shows clear patterns in user preferences, and is ready to expand to Brooklyn and include additional safety factors. |
| **Evaluation:**  We will evaluate the system using both quantitative and qualitative methods. Quantitative evaluation will include comparing our routes with Google Maps using historical crime and accident data, testing algorithm speed, reliability, and scalability, checking the correlation of safety scores with expert opinions, and analyzing route variety, safety-speed trade-offs, and coverage across the city. Qualitative evaluation will include expert reviews by urban planners and safety professionals, comparison with research and best practices, and case studies examining high-risk and low-risk routes in different parts of NYC. Evaluation results will be used to refine algorithms in the short term, guide feature improvements in the medium term, and plan system expansion and potential partnerships in the long term. |
| **Project Management:**  Our project will follow an agile approach, and we’ll use Jira to manage all tasks. We’ve split the project into six main phases (Epics) based on our proposal, and each Epic is broken down into smaller tasks that each team member will handle. Every task will have a short description, estimated hours, and a deadline. Everyone is expected to update their progress in Jira, so we can all see what’s done and what’s still left.  We plan to work in weekly sprints with milestones for each phase. For example, in Weeks 1–3, we’ll focus on collecting and cleaning all the datasets, so everything is ready by the end of Week 3. Later, we’ll move on to safety modeling, machine learning, route optimization, and the user study.  We’ll know the project is going well if tasks are completed on time, all the data is integrated properly, the safety routing system works as expected, and we have a clear, well-documented final report. Other signs of success include everyone contributing equally, communicating well, and following the plan we outlined in our IEEE-style proposal. |

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| **Team Name:** |
| **Team Members:**   |  |  |  | | --- | --- | --- | | **Name** | **Student Number** | **Contact Number** | | Huda Ibrahim | D24126339 | **0834477463** | | Karan Joseph | D24125555 | **0874924547** | | Shalini Kuruguntla | D24126048 | **0892134144** | | Sai Priyanka Basa Shanker | D24125575 | **0899761927** | | Hina Kausar | D24127853 | **0899484178** | |
| **Team Meetings:**  Our team consists of five members, and we decided from the start that regular communication was important to the project's success. Initially, we formed a WhatsApp group to provide quick updates and arrange the availability. After our initial in-person meeting at the University, we decided to formalise our approach by scheduling daily Microsoft Teams call until mid of December. These calls are intended to deliver progress reports, to address problems, and to plan future stories and tasks requires for the JIRA board. We have formalized project board on JIRA and recording our code base and documentations in GitHub public repository.  All members are actively encouraged to attend meetings, however we recognise that conflicts may emerge from time to time. In such circumstances, participants provide updates to the WhatsApp group to ensure that we are moving forward smoothly. Meetings are usually held online for convenience, however face-to-face sessions will be held as needed (for example, milestone planning or presentations).  Decisions are made collaboratively, whenever possible, unanimous consent is preferred, but if consensus cannot be reached, majority voting is employed. Expertise in specific areas is also valued, for example - those with more technical understanding may help guide coding & framework selections. Also, turn-taking in conversations is handled informally, with each person given a time to speak before conclusions are formed. We are also recording our work together as show and tell demo which we planned to store on YouTube channel as well. |
| **Team Conflict:**  So far, our group has been performing well and without serious problems. However, we are aware that conflicts or individual availability routines may cause problems later. To avoid issues, we decided to always maintain open and courteous interactions. If someone is unable to attend a meeting or is delayed in finishing a work, the member is obliged to advise the team via messaging or chat so that expectations are clear.  In the event of remaining issues, we shall first try to address them directly during group sessions by encouraging open conversation. If tensions worsen, we will enlist the module coordinator in mediation. Our approach to conflict resolution will be based on compromise and ensuring that all views are heard. To avoid disagreements, we intend to allocate jobs evenly based on strengths and availability. No single member has veto power; choices will be made by a majority vote, promoting fairness and communal responsibility of outcomes. |