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|  | **EGE205**  **CONNECT SYSTEM DESIGN PROJECT**  **Green IoT**  **PROJECT REPORT**  **(GROUP 2)** | | |  |
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|  | Ong Zachary, Yohannce Sy, Jordan Lim, Bravon Tan, Timothy David  221252K, 223014Z, 222299S, 221987Q, 223211C | | |  |
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| **Part 1: Data Collection** |
| *Instruction:*   * *Identify targeted user group and design questionnaires for data collection.* |
| **Targeted User Group**    **Questionnaires**  [Link to questionnaire](https://forms.gle/YB7nbAU1v6VXNreV6)  1. How concerned are you about the impact of climate change on the environment?  2. What are some of the biggest environmental problems that concern you the most? 3. What are some of the biggest challenges you face in trying to live a more sustainable lifestyle?  4. Have you ever used any IoT devices?  At this point, the survey splits into 2  Answer yes to Q4  5. Do you currently use any IoT devices in your daily life? If so, which ones?  6. What features or benefits did you consider most important to you when considering IoT devices?  7. In which areas of your life did IoT devices make the biggest difference in helping you live a more sustainable lifestyle?  8. How satisfied are you with the performance of your IoT devices?  9. Have you faced any challenges or issues while using your IoT device(s)?  10. Have you recommended IoT devices to others to help them live a more sustainable lifestyle?  Answer no to Q4.  5. What do you see as the biggest barriers to adopting green IoT devices in your daily life? 6. How willing would you be to use IoT devices that help you reduce your environmental impact?  7. How important is it for IoT devices you use to be user-friendly and easy to set up and use?  8. What kind of IoT devices would you be interested in using?  9. What features or benefits would be most important to you when considering IoT devices? 10. How much will you be willing to pay for IoT devices that helped you save money on bills? |

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| **Part 2: Data Management, Interpretation and Analysis** |
| *Instruction:*   * *Perform data management activities on collected data such as data integration, cleansing and transforming using graphical representation.* * *Create a user persona by performing data analysis and interpretation on the collected data using either qualitative or quantitative methods or both.* |
| **Data Graphical Representation**  Forms response chart. Question title: 1. How concerned are you about the impact of climate change on the environment ? . Number of responses: 34 responses.  **Forms response chart. Question title: 2. What are some of the biggest environmental problems that concern you the most? (Select all that apply) . Number of responses: 34 responses.**      Our survey results reveal strong consumer concern for environmental issues and demand for green IoT solutions. 73.5% of respondents indicated environmental impact is important to them. Specifically, 79.4% are most troubled by air pollution. This highlights the need for in-home air purification capabilities. Climate change is another top concern, with 67.6% of participants selecting it. This signals interest in electricity and water conservation features that reduce greenhouse gas emissions. However, 47% noted a lack of green IoT products currently in the market. And among available options, 70% find pricing prohibitively expensive. This feedback highlights an unmet need for affordable, eco-conscious smart home systems.  In summary, consumers are seeking IoT products that address air quality and resource sustainability to mitigate environmental impact. But adoption barriers exist around inadequate options and high costs. Our smart home development should focus on energy and water efficiency features plus air purification to align with preferences. Concentrating innovation on much-needed green technology and cost-optimized design can allow us to deliver on consumer environmental values and capture untapped demand in this market segment.  **Forms response chart. Question title: 4. Have you ever used any IoT devices? . Number of responses: 34 responses.**  **Forms response chart. Question title: 5. What do you see as the biggest barriers to adopting green IoT devices in your daily life? (Select all that apply) . Number of responses: 17 responses.**  **Forms response chart. Question title:  6. How willing would you be to use IoT devices that help you reduce your environmental impact ? . Number of responses: 17 responses.**  **Forms response chart. Question title: 9. What features or benefits would be most important to you when considering IoT devices? (Select all that apply) . Number of responses: 17 responses.**  Our survey data indicates that 50% of survey participants reported having never used any Internet of Things (IoT) devices. This finding suggests there is room for growth in the IoT market among these non-users. However, 64.7% of respondents also noted that they feel IoT devices are prohibitively expensive. This insight reinforces the need for affordable pricing as a key factor to drive adoption. Encouragingly, up to 77% of participants expressed willingness to use IoT devices if there was a demonstrable environmental benefit. This reveals that emphasizing sustainability and energy efficiency could motivate purchases even among price-sensitive consumer segments. With regard to desired features in a smart home system, 70.6% of respondents prioritized energy efficiency. Additionally, 64.7% wanted the system to reduce overall household costs, while 59% hoped it would simplify their lives. In light of these survey findings, our analysis concludes that an inexpensive, environmentally friendly smart home solution would align well with consumer preferences. There appears to be significant interest in IoT capabilities that lower utility bills and everyday hassles through intelligent automation and energy optimization. Though cost remains a primary concern, eco-friendly positioning could overcome price barriers to some degree.  In summary, our proposed smart home system should focus on cost-effective production and green technology to deliver an affordable, energy-efficient product. Emphasizing financial and environmental savings for the consumer will likely resonate stronger than convenience or luxury features. Strategic pricing and sustainability messaging will be crucial to overcoming perceived expense as an adoption barrier among non-IoT users. If executed well, this strategy could allow us to drive sales by increasing value relative to cost.  **Features users would like to see in a Smart Home:**    Incorporating consumer insights was a priority in our smart home development process. We conducted market research to understand what features and capabilities users value most. Participants strongly indicated a desire for systems that conserve resources and promote environmental sustainability. Specific feedback showed demand for electricity and water savings as well as air purification functionality. To align with these preferences and our vision for a green, liveable smart home, we focused our design on key subsystems. Our proposed solution includes energy-efficient smart lighting, thermostats for temperature optimization, advanced air filtration, and water-saving shower systems. These targeted capabilities will help customers reduce utility bills while creating a healthier indoor environment. In summary, our market research and resulting smart home design focuses on providing consumers with green technology that drives energy and water savings. By listening to end-user priorities around sustainability and cost reduction, we have developed practical features that deliver value while also promoting our eco-friendly mission. This consumer-centric approach will ideally translate to strong adoption and satisfaction.  **User Persona** |

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| **Part 3: Idea Generation and Evaluation** |
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| **List of Ideas**   * Intelligent lighting system that automatically turns lights on/off based on room occupancy and allows users to customize brightness settings. * Noise monitoring system that alerts users when sound levels become excessive. * Automated trash can that opens when waved at and alerts users when nearing full capacity for convenient and timely emptying. * Air purification system with sensors that monitor air quality and automatically turn on when pollutant levels are too high, running until clean air levels are restored. * Automated doors for convenient hands-free access. * Smart shower with occupancy detection to automatically start water flow and allow temperature adjustment. * Automatic pet feeder that dispenses meals at scheduled times and detects and clears pet waste. * Smart thermostat that continually optimizes home heating and cooling based on current room temperatures.   **Evaluated and Selected Idea**    **System Block Diagram** |

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| **Part 4: Project Development Plan** |
| *Instruction:*   * *Formulate a project development plan by using Action Plan and Gantt Chart.* |
| **Action Plan**   |  |  |  |  | | --- | --- | --- | --- | | **Project Title:**  Smart Green Home: A Sustainable Living Solution | | | | | **Project Description:**  As Engineers, our role is to create technological advancements and improve the quality of life for others. In this project, our team aim to create a more sustainable lifestyle for our community. We know that Singapore is moving towards becoming a Smart Nation, with the growing trend in more Singaporeans investing in Smart solutions for homes making their lives increasingly convenient. It is our goal to make enhancements to these Smart solutions to provide a cleaner, greener, and more sustainable lifestyle to all users. Regardless of the user's demographic or income, we strive to create a more sustainable lifestyle for them as they adopt more technology in their daily lives.  EcoSphere is a "technology enabled" connected green smart home where users' activities and home operations are monitored and optimized through strategic use of industry 4.0 IoT tools. EcoSphere constantly updates users with essential home data through their personal home accounts, such as energy usage, water consumption, and waste management metrics, making it extremely convenient to track their environmental footprint. We provide users with sustainability insights measured through a series of connected sensors installed throughout the home by applying IoT sensors and principles to a home environment. In order to access one's historical home data and previous sustainability metrics, users can simply log in to their personal accounts by face recognition at the front door. To start monitoring their impact, users must link their account to the home system and the EcoSphere sensors will track their usage and store data. Thereafter, users can view all their home analytics anytime on their personal dashboard after syncing with the data platform.  The newly implemented features in our connected green smart home utilize innovative technology to provide homeowners intelligent automation and enhanced convenience. A highlight is our occupancy-based smart lighting system, which leverages motion sensors to automatically illuminate rooms when occupied and shut off when vacant. Users can also customize brightness preferences for a personalized lighting experience. We have upgraded home security with advanced motion detectors at entryways that identify unauthorized access attempts or suspicious activity, immediately sending alerts to homeowners for peace of mind. Additionally, our proprietary air purification system continuously monitors indoor air quality and activates when sensors detect excessive pollutant levels. The purifiers automatically run until healthy air levels are restored in the home. For optimized temperature control, our intelligent learning thermostat analyses room-by-room energy use and temperatures, predicting heating/cooling needs based on patterns. This allows for maximized efficiency by automatically adjusting settings to keep each room at the desired temperature without wasting energy. These thoughtful automation features provide homeowners the latest smart conveniences for an elevated living experience, while also promoting energy efficiency and sustainable practices with our green technology. We are excited to deliver these innovative new intelligent home solutions to enhance our customers' lifestyles. | | | | | **Task Description** | **Estimated Duration** | **Required Resources** | **Responsible by** | | Group Report (Part 1 to 5) | 9 Days | Words, Canva | Zachary and Yohannce | | Smart Thermostat subsystem | 1 Week | BBBW, Python, | Zachary | | Smart Security subsystem | 1 Week | BBBW, Python. wifi | Yohannce | | Smart Shower subsystem | 1 Week | BBBW, Python, wifi | Jordan | | Smart Lighting subsystem | 1 Week | BBBW, Python, wifi | Bravon | | Smart air purifier subsystem | 1 Week | BBBW, Python, wifi | Timothy | | Integration | 2 Weeks | HTML, CSS, Python, Flask, Socketio | Timothy | | Web Design | 2 Weeks | CSS | Zachary and Yohannce | | Website (Coding) | 2 Weeks | HTML, Socketio, Javascript | Zachary and Timothy | | Slides | 5 Days | Powerpoint,  Photoshop | Yohannce | | Script | 4 Days | Words, ChatGPT | All members | | Presentation | 3 Days | Classroom, laptop | All members |   **Gantt Chart** |

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| **Part 5: Project Deployment Plan** |
| *Instruction:*   * *Formulate a project deployment plan with key milestones by considering the availability of the resources needed.* |
| **Product Launch Plan**    **Product Maintenance and Support Plan**  Green Smart Home Maintenance and Support Plan  Warranty: 5 years comprehensive warranty for all devices and systems.  Onsite support: Engineer dispatch within 4 hours for hardware issues. Immediate remote support for software issues.  Devices replaced onsite or removed for repairs as needed.  Network uptime guarantee: 99.9% uptime for cloud-based system. 24/7 remote and onsite engineer support for network issues.  Hardware replacements as needed within 4 hours.  Preventive maintenance: Annual health check and cleaning of all devices. Firmware upgrades as recommended by manufacturer.  Remote monitoring: 24/7 cloud-based system monitoring of all devices for proactive issue identification and resolution.  Priority support: 24/7 phone and email support for system impacting issues with 1 hour response time.  Home environmental audit: Annual audit of home for opportunities to improve energy efficiency and recommendations for smart upgrades.  **Marketing Plan**  EcoSphere aims to launch a digital marketing campaign targeting environmentally conscious homeowners. The campaign will promote EcoSphere as an innovative smart home solution that minimizes energy consumption and carbon footprint in residences.  The campaign will leverage major social media platforms including Facebook, Instagram and YouTube will highlight EcoSphere's key benefits such as real-time energy monitoring, automation of household appliances and HVAC, proper insulation recommendations and automatic notification of utility bill spikes. The visual ads will feature EcoSphere's sleek hub and mobile app interface alongside imagery of a sustainable lifestyle and green living.  The campaign will consist of three difficulty levels proportional to customer involvement. Level 1 will involve liking our social media pages and signing up for our newsletter. Upon completion, customers get eco-friendly gift items. Level 2 will require customers to share one of our social media posts. Upon completion, customers get reusable EcoSphere branded water bottles. Level 3 will require customers to watch an educational webinar on EcoSphere. Upon completion, customers get EcoSphere branded t-shirts.  The promotion aims to rapidly build brand awareness for EcoSphere, establish us as a tech leader in the green living space and acquire new customers through an interactive and rewarding digital experience. |