SOAREBOARD: A Sustainable Solution for Green Transportation

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***Abstract* — This paper presents a solar-powered electric skateboard that offers a sustainable and eco-friendly solution for green transportation. Focusing on the popularity of skateboarding among University of Central Florida students, our project aims to enhance its environmental benefits through the integration of clean and renewable energy. By utilizing solar power to charge the skateboard's battery, we effectively address common issues faced by electric skateboards while ensuring comparable portability and weight distribution to existing models. We explore two control options, a handheld controller or a dedicated mobile app, both operated through a microcontroller connected to the motor. Our research-driven approach fills the gap for affordable and accessible solar-powered skateboards, providing individuals with a sustainable and green mode of transportation to reduce their carbon footprint effectively.**

***Index Terms* — Solar cells, Motor Driver, MPPT Solar Charger, Bluetooth Module.**

I. Introduction

The project aims to develop the Soareboard, a solar-powered electric skateboard that overcomes the limitations of traditional lithium-ion batteries. By harnessing solar energy, the goal is to provide riders with an uninterrupted and eco-friendly riding experience. The Soareboard offers extended travel periods without the need for frequent recharging, reducing reliance on harmful chemicals and minimizing the environmental impact. The team is dedicated to designing a high-quality electric skateboard that not only promotes sustainability but also enhances rider safety and comfort. With features like exterior LED lights for enhanced visibility and a focus on functionality, the aim is to create a cutting-edge solution that revolutionizes the world of electric skateboards.

Through clear goals and diligent progress tracking, the project is committed to achieving objectives. The Soareboard project sets out to deliver extensive battery life, enabling riders to reach their destinations without worry even in low sunlight conditions. Additionally, the aim is to ensure high speeds by having a motor and electronic speed controller capable of handling weight and providing sufficient torque. Safety is a top priority, and careful consideration has been given to choosing the appropriate wheels and deck to ensure a secure and stable ride for users of all ages and skill levels. By pursuing these goals, the project strives to create a solar-powered electric skateboard that not only meets high standards of functionality and safety but also inspires further advancements in sustainable transportation.

II. Engineering Specifications

In this project, three key engineering specifications have been identified. The first specification focuses on achieving a battery charging capacity of at least ninety percent through efficient utilization of the solar cells. This is essential to create a sustainable and eco-friendly solution. By optimizing the solar cell performance, our objective of harnessing renewable energy for the skateboard can be met.

The second specification aims to establish a responsive app control system, with the goal of the board promptly responding to commands within thirty seconds of connecting to the Bluetooth module. This rapid response time enhances user-friendliness and ensures a seamless interaction between the app and the board. Minimizing delays between user input and board action improves the overall user experience.

The final specification sets a weight capacity requirement for the motor and motor driver, enabling them to support up to one hundred and thirty pounds. This specification considers the motor's capabilities, the voltage and current capacity of the battery, and the anticipated weight of the rider. By ensuring the motor and motor driver can handle this weight, we provide a safe and reliable riding experience within the specified weight range.

By meeting these engineering specifications, the system is designed to operate securely while promoting environmental sustainability and delivering user-friendly functionality.

III. System Components

This section serves as a semi-technical introduction to each of the system components we have developed for the project. It aims to provide an overview of the key elements involved in our innovative solar-powered electric skateboard design. By delving into the technical aspects, we can gain a deeper understanding of how each

component contributes to the overall functionality and performance of the skateboard.

A. Motor

The motor plays a vital role in the operation of an electric skateboard, providing the necessary propulsion for movement. Typically, the motor is connected to the rear set of wheels and linked to the axle, causing them to rotate and propelling the skateboard forward.

In electric skateboards, one of the essential components is the DC motor. Among DC motors, brushed DC motors are the most commonly used due to their simplicity and affordability. These motors rely on brushes and commutators to control the magnetic field within the motor. By making physical contact with the rotating metal ring known as the commutator, the brushes switch the current flow in the motor's windings, generating the magnetic field that drives the motor's rotation.

Brushed DC motors are excellent speed control and are well-suited for powering small appliances, toys, and power tools. However, they require regular maintenance as the brushes and commutators wear out over time and need replacement. Additionally, brushed DC motors can produce electrical noise due to the mechanical contact between the brushes and the commutator, which can interfere with electronic circuits and cause electromagnetic interference. Nevertheless, these motors are still widely used in various applications, including automotive power windows, HVAC blowers, and pumps, owing to their simple design and ability to provide high torque at low speeds, so it will be a great fit for the Soareboard. The motor that is on the Soareboard is 775 Motor.

B. Solar Cells

The Soareboard stands out among other electric skateboards due to its unique reliance on solar power. By incorporating solar cells directly onto the board, it harnesses sunlight to generate renewable energy, providing a sustainable and eco-friendly mode of transportation. These solar cells absorb photons from the sun and convert them into electrical energy through the photovoltaic effect. The generated electricity is stored in the onboard battery, serving as an energy reservoir to power the skateboard's motor and control systems. This integration of solar power not only reduces reliance on traditional charging methods but also promotes renewable energy utilization, contributing to a greener and more sustainable future.

The selection and integration of high-quality solar cells onto the Soareboard are crucial for efficient solar power generation and meeting performance requirements. Factors such as cell efficiency, durability, and compatibility with the skateboard's design must be carefully considered. By embracing solar energy, the Soareboard showcases the potential of renewable energy in transportation, offering riders an eco-friendly and reliable means of commuting while reducing environmental impact. The Soareboard has SUNYIMA 10Pcs Mini Polycrystalline Solar Panels Cells.

C. MPPT Solar Charger

The inclusion of the MPPT Solar Charger within our system is crucial for ensuring the efficient and safe operation of the entire setup. Acting as a vital component, the MPPT Solar Charger plays a pivotal role in regulating the voltage input to the battery, effectively protecting it against overcharging and discharging. This feature is of utmost importance as it safeguards the battery's longevity and overall performance.

With an input voltage range of nine to twenty-four volts, the MPPT Solar Charger aligns perfectly with our project's requirements. This versatility allows it to accommodate the voltage output from the connected solar cells, ensuring an optimal charging process. Given that our system operates with two twelve-volt batteries, resulting in a combined voltage of twenty-four volts, the MPPT Solar Charger is well-suited to provide a safe and efficient charging mechanism.

Furthermore, the MPPT Solar Charger offers an output current range of two to five amps. This current range proves to be ideal for our project, as our motor requires a minimum current of four amps to operate effectively. The MPPT Solar Charger's ability to meet this current requirement ensures a reliable power supply for the motor, enabling smooth and consistent operation.

One of the key advantages of the MPPT Solar Charger is its ability to regulate the flow of voltage from the connected solar cells to the battery. As not all solar cells receive equal exposure to sunlight, this regulation mechanism becomes essential in maintaining a balanced and optimal charging process. By dynamically adjusting the voltage transfer, the MPPT Solar Charger ensures that the battery receives the necessary power while protecting it from any potential damage or imbalances.

D. Battery

The Solar Battery is undeniably the cornerstone of this project, playing a pivotal role in its overall functionality. This essential component serves as the primary energy storage unit, responsible for collecting and storing the energy generated by the Solar Panels. Its fundamental purpose is to ensure a reliable and sustainable power source for the operation of the skateboard's motors.

By efficiently capturing and storing the solar energy harnessed by the Solar Panels, the Solar Battery becomes the reliable reservoir of power that drives the movement of the motors. This crucial function enables the skateboard to propel forward, offering a smooth and eco-friendly riding experience. To fulfill this role, the Soareboard will be equipped with the Miady 2000 Cycles 12V 6Ah battery, known for its exceptional performance and durability.

The integration of the Solar Battery within the Soareboard's design ensures that the captured solar energy is effectively harnessed and utilized, providing a sustainable and renewable power source for the skateboard. This not only promotes a greener and eco-friendly mode of transportation but also offers an extended operational time, allowing riders to enjoy longer journeys without concerns of power depletion. The Solar Battery stands as a vital component that enables the Soareboard to fulfill its vision of combining innovative technology and renewable energy for a more sustainable and enjoyable riding experience.

E. Electronic Speed Controller

The motor drive controller board is essential in this project as it enables precise control, efficient power management, and motor protection for the electric skateboard. Acting as the interface between the user's input and the motor's output, it converts commands into appropriate control signals, allowing for fine-grained control over acceleration, deceleration, and speed. Additionally, the controller board incorporates safety features to prevent damage from overcurrent or overheating, ensuring a smooth and reliable riding experience while protecting the motor and electrical components. The motor speed controller that is used for the Soareboard is the HiLetgo BTS7960 43A.

F. Arduino

The decision to utilize Arduino as the controller for our project was carefully considered due to its remarkable programmability and open-source nature. Arduino offers a wide range of commercially available options, each with its unique features and capabilities. After thorough evaluation, it was determined that the Arduino Uno R3 best suited the specific needs of the Soareboard project. This up-to-date version of Arduino boasts impressive specifications, including support for 14 digital interfaces and 6 analog interfaces. Such versatility allows for seamless integration of various hardware components, enabling complex designs and ensuring the optimal functionality of the Soareboard.

Operating within a voltage range of 7 to 20 volts, the Arduino Uno R3 seamlessly aligns with the power requirements of the Soareboard. This compatibility ensures efficient power management and allows for a seamless connection between the Arduino board and other essential subsystems. The Arduino Uno R3's reliability and performance make it a dependable and robust controller for the Soareboard, enabling effective communication with other components, precise control of the motor, and seamless integration with additional features such as the rain sensor, buzzer, and Bluetooth module.

By selecting the Arduino Uno R3 as the core controller, we have harnessed the full potential of this versatile platform, enabling us to create a highly functional and responsive electric skateboard. The integration of Arduino's programmability and compatibility with various hardware components has significantly contributed to the successful realization of the Soareboard project.

G. Bluetooth Module

In the project, the HC05 Bluetooth module has been integrated to establish a wireless connection between the electric skateboard and a mobile app. This module serves as a communication bridge, facilitating seamless interaction and control between a user's smartphone and the skateboard. With its compatibility and reliability, the HC05 Bluetooth module operates on the Bluetooth 2.0 protocol, ensuring a stable and secure wireless connection. Through pairing the module with the mobile app, users can effortlessly control functions such as speed adjustment, braking, and battery monitoring. The bidirectional communication, enabled by the utilization of the Serial Bluetooth Protocol (SPP), facilitates real-time data exchange, ensuring precise and responsive control of the skateboard. Configured as a slave device, the HC05 Bluetooth module easily pairs with the mobile app. Once connected, the module receives commands and sends status updates back to the app. Its compatibility with widely adopted Bluetooth protocols ensures seamless integration with various mobile devices. By incorporating the HC05 Bluetooth module into the design, a user-friendly and efficient wireless control system has been achieved for the electric skateboard, providing convenient and intuitive control over the skateboard's features and enhancing the overall riding experience.

H. User Interface

The user interface (UI) of the app has been meticulously crafted to ensure an intuitive and seamless experience when controlling the electric skateboard. With a clean and visually appealing layout, the UI incorporates clear icons and intuitive controls, allowing users to effortlessly access and customize settings such as speed control, braking, and

riding modes. The dashboard provides real-time information, including battery level and speed, allowing riders to stay informed and make informed decisions while riding. Additionally, advanced features like speed limit customization and map view further enhance safety and convenience, offering riders a comprehensive and personalized experience. With its visually appealing design and user-friendly interface, the app's UI empowers riders to have complete control over the skateboard, enabling them to enjoy a smooth and immersive riding experience.

I. Rain Sensor

In addition to the aforementioned components, the board will be equipped with a rain sensor, specifically the LM393, and a buzzer, the AI-1223-TWT-12V-R, to detect and alert the rider of rainy conditions. This feature holds significant value for the rider's safety, as it serves as a warning system to take immediate action in response to rain.

The rain sensor, LM393, continuously monitors the presence of raindrops on the skateboard's surface. Upon detecting rain, it sends a signal to the system, triggering the buzzer to emit a loud and distinctive sound. This audible alarm immediately alerts the rider that there is rain outside and prompts them to take precautionary measures. The loud buzzing serves as a clear indication that it is necessary to discontinue riding and seek shelter to avoid any potential hazards posed by wet surfaces or reduced traction.

By integrating the rain sensor and buzzer into the board's design, we aim to prioritize rider safety and provide an additional layer of awareness during inclement weather conditions. This feature ensures that riders can make informed decisions and promptly react to changing weather circumstances, minimizing the risk of accidents or injury due to riding in unsafe conditions.

IV. System Concept

The Soareboard represents a harmonious integration of eco-friendly and efficient hardware and software components, working seamlessly to provide users with a simplified and intuitive control experience at the click of a button. At the core of this system are the MPPT Solar Charger, solar cells, and battery, which collectively ensure optimal power supply while safeguarding against overcharge or discharge. The MPPT Solar Charger facilitates efficient charging of the battery by regulating the power flow from the solar cells, enhancing overall energy utilization.

Once the battery is fully charged, the motor driver establishes a direct connection to the battery, drawing the required twenty-four volts to power the electric motor. To enable the operation of the Arduino UNO Board, a voltage divider circuit is employed, reducing the voltage from twenty-four volts to ten volts. This voltage reduction ensures that the Arduino UNO Board receives the appropriate power supply for its functionality.

Upon establishing these connections, various components such as the Bluetooth module, rain sensor, and buzzer, all interfaced with the Arduino Board, function as expected. The Bluetooth module enables wireless connectivity, facilitating seamless communication between the electric skateboard and the user's smartphone or device. The rain sensor and buzzer enhance safety and user awareness, alerting riders of inclement weather conditions and providing necessary notifications during their ride.

By successfully establishing these hardware connections and enabling the Bluetooth module, the Soareboard achieves its primary objective of being both eco-friendly and user-friendly. The combination of sustainable power generation through solar cells, efficient power management through the MPPT Solar Charger, and intuitive wireless control via the Bluetooth module culminates in a reliable and environmentally conscious electric skateboard experience.

A. First Subsystem

The first subsystem, the solar cell subsystem, plays a vital role in charging the battery of the Soareboard. By connecting three solar cells in series, the desired power capacity is achieved to effectively charge the twelve-volt battery. To facilitate this charging process, an MPPT Solar Charger is utilized, which has an input range of eight to twenty-six volts, perfectly aligned with the voltage requirements of the battery. This intelligent charger ensures that power distribution is optimized, preventing issues such as overcharging or discharging by regulating the flow of energy from the solar cells.

The MPPT Solar Charger is indispensable in managing the variations in sunlight exposure among the solar cells. By employing maximum power point tracking, it enables efficient power conversion and distribution, maximizing the utilization of solar energy. This system not only ensures that the battery receives the appropriate voltage to charge effectively but also enhances the overall performance and longevity of the battery. Through this integrated solar charging subsystem, the Soareboard harnesses renewable energy and minimizes reliance on traditional charging methods, aligning with its eco-friendly and sustainable design principles.

B. Second Subsystem

To ensure the overall functionality of the Soareboard, two different voltage sources are derived from the charged battery. The first voltage source provides 24 volts, which is essential for powering the motor. This voltage supply is directly connected to both the BTS7960 motor driver and the 775 motor. The motor driver serves a crucial role in controlling and driving the motor, utilizing pulse width modulation (PWM) to regulate the motor's speed and direction.

The second voltage source takes the 24 volts from the battery and utilizes a voltage divider circuit to obtain a stable 10 volts. This lowered voltage is specifically designed to power the Arduino UNO Board, the central control unit of the Soareboard. Once the Arduino Board is powered, it serves as the control hub for various components, including the rain sensor, buzzer, and Bluetooth module.

With the Arduino Board powered, the rain sensor can effectively detect raindrops, providing important information for the rider. The buzzer, when triggered, serves as an auditory alert system, notifying the rider of any relevant warnings or notifications. Additionally, the Bluetooth module enables wireless communication between the Soareboard and external devices, such as a smartphone or tablet, facilitating remote control and monitoring of the electric skateboard.

By establishing these essential voltage sources and connecting them to their respective components, the Soareboard system becomes capable of powering the motor, detecting raindrops, and enabling wireless control. This comprehensive power distribution setup ensures that the system functions smoothly, allowing for motor operation, environmental sensing, and convenient user interaction.

C. Third Subsystem

The third subsystem of our project incorporates the HC-05 Bluetooth module, the ATMEGA328P microcontroller unit (MCU), and the Arduino Uno Board. While the ATMEGA328P MCU shares similarities with the Arduino Uno Board, the latter is essential for connecting and enabling the functionality of all other components on the skateboard. The HC-05 Bluetooth module plays a vital role in establishing wireless communication between the electric skateboard and the accompanying app. This seamless connection empowers users to have complete control over the skateboard's speed, allowing them to conveniently increase or decrease velocity as desired. By connecting the board to the module, users can access real-time speed information displayed within the app's interface, providing a comprehensive and user-friendly experience.

The Arduino Uno Board acts as a crucial intermediary, facilitating communication and coordination between the HC-05 Bluetooth module and the rest of the skateboard's components. It ensures the proper transfer of signals and instructions, enabling the user's commands to be accurately translated into desired actions on the skateboard. With the integration of the Arduino Uno Board, the entire system functions harmoniously, ensuring a seamless user experience and precise control over the skateboard's speed. This subsystem exemplifies the collaborative interplay between the HC-05 Bluetooth module, the ATMEGA328P MCU, and the Arduino Uno Board, ultimately delivering a user-friendly interface that enhances the overall functionality of the electric skateboard. The wireless connection established through the Bluetooth module empowers users to effortlessly adjust the skateboard's speed, while the Arduino Uno Board serves as a critical intermediary, ensuring effective communication and coordination among all components.

V. Hardware Details

The top of the board includes the solar cells, designed to absorb solar power as energy. Included on the top of the board is a Resin Coating, designed to protect the cells from erosion and overall weather damage. Additional features that were considered for the top of the board that are under the area of stretch goals include LEDs, and a speedometer built into the board. The purpose of the LEDs is to add an additional element of design to the board, allowing the user to change the color of the board, which would be a nice feature. The Speedometer would allow the user to look down at the board as they were in motion and see how fast they were going.

On the bottom of the board, the features included are the solar battery and the motor. The solar battery is designed to store the power generated from the solar cells. This means that there will have to be a connection from the cells to the battery, either around or through the board. The second major feature on the bottom of Soareboard is the motor. The motor is designed to forcefully propel the board forward by rotating the wheels. The motor will often be connected to the axle on the back of the wheels as it is more preferred for stability when compared to the front set of wheels. The motor requires electrical power to function, for that reason it is to be connected to the solar battery to receive that power. It is similar to the solar cells in that aspect, making all the major features of the board connected through a series of subsystems.

A separate piece of equipment that plays a part in the hardware of the overall system is an external controller. The controller would be designed to control the board, more specifically the motor. There would have to be some connection between the controller and the motor. It would likely have to be a wireless connection, as a wire coming from the controller to the motor would be too inconvenient. There are options for a wireless connection, one prominent option would be Bluetooth, many products these days use Bluetooth as a way to create a wireless connection.

One last feature in the prototype design is a smartphone app. In the modern world, there are many ways to create apps, the Soareboard team would utilize these services to create our app. There would be a few important functions the app would serve. The main function of the app is to set the speed of the board, allowing the speed to be gradually increased or decreased. Notably, the app would not have a stop function, as that would be considered dangerous for the board to stop suddenly.

By harnessing the power of solar cells, our Soareboard operates entirely on clean and renewable energy sourced from the sun. The solar cells play a vital role in the energy flow of the system, capturing sunlight and converting it into electrical power. This energy is then transferred to a central battery, serving as the energy storage unit that powers the entire board. The battery acts as a crucial link, connecting all elements together.

The power from the battery is distributed through the printed circuit board (PCB), which acts as the central controller for the entire board. The PCB sends signals and instructions to each component, including the motor, LEDs, speedometer, and the controller/app that receives user inputs. These elements rely on the power provided by the PCB and are programmed to work in sync with its instructions. While the LEDs serve as an additional accessory, the speedometer, motor, and controller are integral components that ensure the board functions as intended.

The flow of power guides the sequential design process, dictating that each element must be constructed and tested before moving on to the next. This ensures that each component operates smoothly and efficiently. As the project progresses, the controller becomes the final piece of the puzzle. With the creation of our app, the controller establishes the connection that brings the entire project together, enabling the board to move according to the user's instructions.

Through this carefully orchestrated flow of power and integration of components, our Soareboard showcases the seamless harmony between clean energy utilization and efficient functionality. The use of solar cells and the central control provided by the PCB not only demonstrate our commitment to sustainable practices but also ensure the board operates reliably and in line with the user's commands.

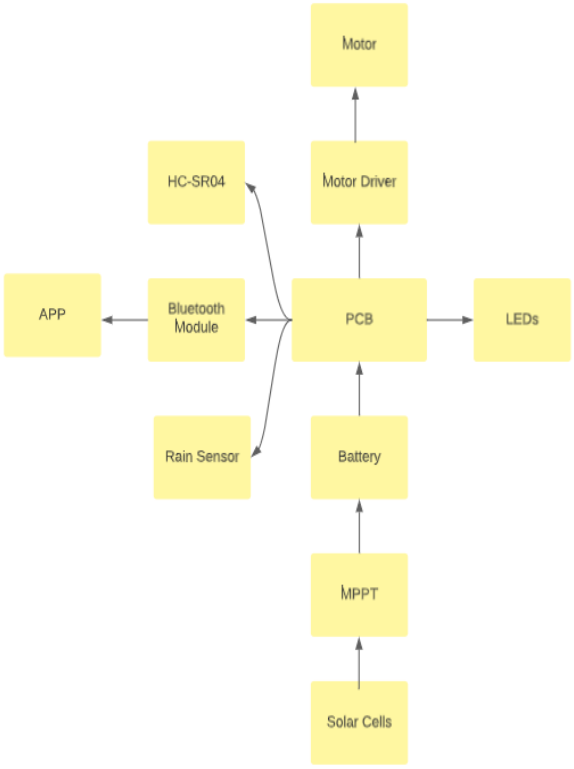

Fig. 1. Hardware Block Diagram

VI. Software Details

Developing an app for controlling the electric skateboard offers a user-friendly interface that aligns with the widespread use of smartphones. It provides a convenient and intuitive control mechanism, allowing users to adjust speed, monitor battery levels, and access various features. Additionally, opting for an app-based control system reduces the need for separate physical controllers, contributing to the eco-friendliness of the electric skateboard. The app's flexibility enables future enhancements and integration with other smart devices, offering a modern and customizable experience for riders in line with evolving digital trends.

At first the option of assembling a physical controller made up of 3D parts and an electric circuit. After a few considerations, the app was the best solution since our main goal is to create an eco-friendly board, and since everyday more and more people acquire smartphones, developing an app was the best approach.

The main concern was to make this wireless communication possible. After a lot of research, the three components that will make this configuration possible were the HC-05 Bluetooth Module connected to an Arduino UNO R3 Board, and an Android phone.

A. App Development

The next crucial step involved testing the communication between the three components and ensuring their compatibility. To facilitate this evaluation, we utilized the highly effective MIT App Inventor tool. Initially, a dedicated app was created to verify the Bluetooth communication between the Arduino and the smartphone. This was accompanied by the development of specific Arduino code to establish and facilitate this connection.

Subsequently, another app was developed using MIT App Inventor to comprehensively test the functionality of the BTS 7960 motor driver, 775 motor, HC-05 Bluetooth module, and power supply. This app was designed to allow users to increase or decrease the speed of the electric skateboard up to a maximum of 255 RPM, while simultaneously displaying the real-time velocity of the board during the ride. Notably, the decision was made to exclude a STOP button due to safety concerns associated with pressing it at high speeds, which could potentially result in accidents.

A flowchart was devised to outline the app's logical sequence and highlight the actions that users should be mindful of during their travel.

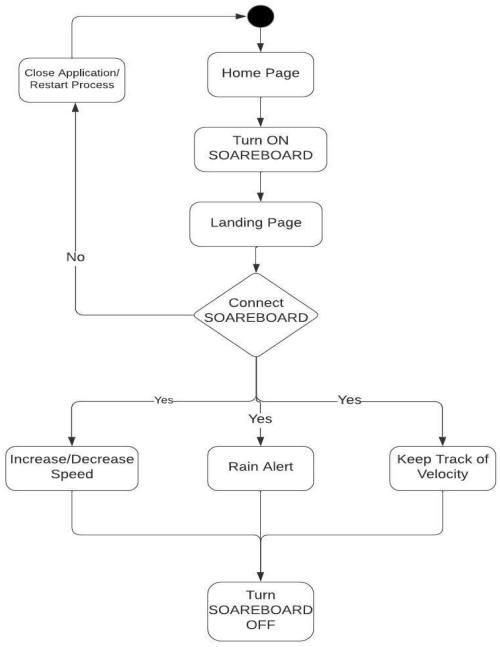

Fig. 2. Software Flowchart

VII. Board Design

The final board design of the Soareboard represents the culmination of meticulous planning and careful integration of all system components. A key aspect of the design is the positioning of the printed circuit board (PCB) on the underside of the board. This deliberate placement serves multiple purposes, including optimizing the overall functionality of the system and enhancing the aesthetic appeal of the electric skateboard.

Throughout the development process, we conducted rigorous testing and made iterative improvements to ensure that the final board design excels in performance, durability, and long-term reliability. This comprehensive testing allowed us to fine-tune the integration of various components, ensuring seamless communication and efficient operation of the system as a whole.

By achieving an optimal balance between functionality and visual aesthetics, the final board design of the Soareboard not only delivers exceptional performance but also offers an appealing and streamlined appearance. The careful integration of all system components on the underside of the board reflects our commitment to creating a high-quality, reliable, and visually pleasing electric skateboard.

VIII. Conclusion

This project aims to revolutionize transportation by developing the Soareboard, a solar-powered skateboard that offers an affordable, emission-free, and convenient mode of transportation. Harnessing the abundant energy of the sun, this innovative skateboard provides an eco-friendly alternative to traditional modes of transportation. Through the integration of readily available components, the Soareboard efficiently recharges its battery using solar power and can be effortlessly controlled through a user-friendly app. This approach reduces reliance on fossil fuels and promotes sustainable commuting and exploration.

The primary goal of this project is to showcase the immense potential of renewable energy in the realm of transportation. Creating the Soareboard serves as an inspiration for individuals to embrace eco-friendly alternatives and contribute to a cleaner and greener future. Furthermore, this project presents a valuable opportunity to gain practical experience and enhance engineering and sustainable design skills. Through comprehensive research and meticulous planning, we have confidence in our ability to develop a high-quality solar-powered skateboard that not only delivers a fun and efficient riding experience but also encourages wider adoption of sustainable transportation solutions.

IX. Acknowledgment

The authors wish to acknowledge the assistance and support of Dr. Lei Wei. The authors would also like to acknowledge ChatGPT for its invaluable assistance in grammar and organization.

We express our heartfelt appreciation to the professors who have generously agreed to review our diligently prepared project, as well as friends and family who have supported all of us along the way.

The Engineers

Franco Curcio will receive his Bachelor's of Science in Electrical Engineering in August of 2023.

Julia Lampert will receive her Bachelor's of Science in Electrical Engineering, specifically on the power and renewable energy track in August 2023, and she is taking a job with HBK Engineering in Sanford, FL, where she will be working on the redesign of power lines.

Antonia Jimenez will receive her Bachelors of Science in Computer Engineering in August of 2023, and she has taken a job with Dell, where she will be working on web services.

Devon Jacobs will receive his Bachelor's of Science in Electrical Engineering in August 2023.

References

[1] J. M. Brokking, "Project building an electric skateboard," Brokking.net - Project building an electric skateboard-Home., http://www.brokking.net/longboard_main.html (accessed Jul. 6, 2023).

[2] B.-I. Projects and Instructables, "DIY Electric Skateboard," Instructables, https://www.instructables.com/My-Homemade-Electric-Skateboard/ (accessed Jul. 6, 2023).