International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 9
***Article Received:** 29 September 2023 **Revised:** 13 November 2023 **Accepted:** 27 November 2023*

Solar and Dynamo Powered Ev Using Fingerprint Authentication

T. Sirisha[1]
Electrical and Electronics Engineering Hyderabad Institute of Technology and Management Hyderabad, India
thrilangi.sirisha55@gmail.com

V. Vasavi Priya[2]
Electrical and Electronics Engineering Hyderabad Institute of Technology and Management Hyderabad, India
vasavipriya090132@gmail.com

D. Srinivas Varma[3]
Electrical and Electronics Engineering Hyderabad Institute of Technology and Management Hyderabad, India
varma.prabbas@gmail.com

V. Harsha Vardhan Reddy[4]
Electrical and Electronics Engineering Hyderabad Institute of Technology and Management Hyderabad, India
harshavundhyala@gmail.com

K. Devi Priya[5]
Electrical and Electronics Engineering Hyderabad Institute of Technology and Management Hyderabad, India
kattamuridevipriya@gmail.com

Abstract— Nonrenewable energy sources are already interfering with the availability of electricity. Today, the primary emphasis is on the generation of electricity from renewable sources. This proposal proposes a feasible design solution in the shape of a user-friendly three-wheeler. A fingerprint-accessible electric vehicle. This electric vehicle uses solar power and a self-changing dynamo to charge its battery. The battery serves as the vehicle's power source.

A microcontroller serves as the system's primary controller. It is connected to a fingerprint module, a relay, the car ignition, and an LCD. The Microcontroller reads the input from the fingerprint module and, if it is legitimate, grants access to the ignition system. The status will be displayed on the LCD.

In addition, we're adding three more sensors: speed, temperature, and voltage. Lithium-ion batteries can be harmful if not used within the safety-operated area (SOA). To avoid this, we calculate the temperature of the lithium-ion battery when it exceeds 49.9℃. It will make a sound through the buzzer. This can prevent damage to the battery and the person driving the vehicle. Voltage Sensor is designed to monitor battery charging and discharging time, which is displayed on the LCD. A speed sensor is used to determine the speed of the vehicle.

keywords: Solar panel, Dynamo, Fingerprint module, LCD display, Microcontroller, Speed, Temperature, Voltage

I. INTRODUCTION

The fundamental purpose of developing an electric vehicle is to make a light, inexpensive vehicle that may be used in small towns. We designed numerous separate subsystems with the goal of minimizing weight and expense. The electric vehicle features a mild steel frame, a controller circuitry, a biometric entrance system, a battery management system, and a speed sensor.[1]

This vehicle has a self-charging dynamo and a solar panel that charge the EV battery. The vehicle's rear wheels are equipped with dynamos. While driving, the dynamo converts mechanical energy to electrical energy, which is subsequently stored in the EV battery via the charging circuit. The solar panel is attached to the back of the EV and is supported by an iron frame. Solar energy is utilized to charge batteries.[2]

An embedded system combines software and hardware to execute a specific task. Microcontrollers are among the most common devices used in embedded goods. A microcontroller accepts data as inputs, manipulates it, interfaces it with other devices, controls it, and finally outputs the outcome. We are utilizing the PIC 16f877A microcontroller, which has 40 pins. Input from the components is routed to the microcontroller, which processes the data from the users and outputs as needed.

To start the vehicle, we inserted a key as well as a fingerprint module from r303, a biometric security device that records and authenticates an individual's fingerprint for a variety of purposes, most notably security and access control. To utilize a fingerprint module, a person's fingerprint must be registered. During enrollment, the device takes the fingerprint and generates a template for future use. When attempting to access a device or a secure location, the user places their finger on the fingerprint module. The module then collects their fingerprint, turns it to a template, and compares it to the templates saved for authorized users. If a match is discovered, access is given.[12]

Our project's key benefit is the use of solar and dynamos. We are employing two solar panels and two dynamos. Solar panels are meant to harness the sun's plentiful energy and transform it into power. These panels are made up of many solar cells, which are commonly constructed of semiconductor materials like silicon. When exposed to sunlight, these cells produce an electrical current via the photovoltaic effect. Solar panels can charge a vehicle in two hours. The batteries store the energy from the sun. In addition to solar panels, we have a dynamo, which uses the motion of the bicycle wheel to generate electricity and store it in batteries. [3]

The energy from the sun and dynamo is stored in a battery. We are using four rechargeable batteries connected in parallel, with a rating of 48V and 7Ah. The batteries are connected in series because it increases battery voltage and resulting in lower current in vehicle.

As we all know, when electric vehicles are charging, there is a potential that the temperature may rise owing to a large load or the battery will be heated because to the low level of acids. We utilise a temperature sensor to identify temperature increases that are abnormal. The input contains batteries, while the output contains a buzzer, relay, and LCD display. When the sensor detects an abnormal temperature, it sounds a buzzer and illuminates a green LED. In addition, we are using a voltage sensor, which will provide continuous voltage monitoring by sensing and displaying the voltage on the LCD. To determine how fast a vehicle is driving, we are adding a speed sensor that will display the vehicle's speed on an LCD display.

Nowadays, we use electric vehicles powered by batteries or solar power. We charge an EV using solar electricity, which takes a long time. However, it is not possible to charge quickly during the windy or rainy seasons. We have a car that uses renewable resources like solar energy and a battery. Since solar panels are inoperable during the rainy season, we employ dynamometers, which detect motion and store energy in the form of batteries to assist in moving the vehicle. However, if we lose the key, our automobile will be unsafe. To prevent starting issues in case of key loss or theft, we utilize our vehicle's fingerprint to start it. No one else will be able to start our vehicle without fingerprint recognition.[11]

II. HARDWARE COMPONENTS

Components	**Quantity**	**Specifications**
Solar panel	**2**	**48V,20W**
Dynamo	**2**	**48V,10W**
Rechargeable Battery	**4**	**48V,7Ah**
Hub Motor	**1**	**48v,800W**
Microcontroller	**1**	**16F877A**
LCD Display	**1**	**16*2**
Voltage Sensor	**1**	**50V**
LM35 Sensor	**1**	**60micro amps**

Fingerprint module	**1**	**r303**

Table 1: Hardware components

III.SOFTWARE TOOLS

To create the circuit and access the microcontroller, we employed code. The circuit diagram is created using EXPRESS PCB and PIC C Complier.
Express PCB is CAD programme that creates layouts for printed circuit boards (PCB). Express PCB in which we designed the circuit diagram, which will have access to electrical and electronic equipment such as microcontrollers, circuit breakers, sensors, and so on, which are connected via connecting wires.

The pic microcontroller used in the project requires programming code to perform properly. To dump the code into the microcontroller, the pic c compiler is used. This integrated C development environment enables developers to quickly generate highly efficient code from an easily maintainable high-level language. Built-in PIC hardware access routines in the compiler include READ_ADC, which reads a value from the A/D converter.

IV.BLOCK DIAGRAM

A self-charging dynamo and solar energy are used to charge the battery of this electric vehicle. The vehicle is powered by batteries.

A microcontroller is the key controlling element of the entire system. It communicates with a fingerprint module, relay, LCD display, key, and vehicle ignition. If the input from the finger print module is valid, the microcontroller scans it and allows access to the ignition system. On the LCD, the status will be displayed.
A microcontroller attached to a controlled power supply with a voltage range of 0 to 60 is connected. The microcontroller receives 24V from the battery as supply power; the controller only requires 5V, which is converted with the aid of a transformer, rectifier filter, and regulator.

An LCD will show the fingerprint when it is accessible via a microcontroller. We are using two control buttons to store fingerprints. The control buttons are attached to pins RD2 and RD3, while the fingerprint module is connected to pin RE0/RD.

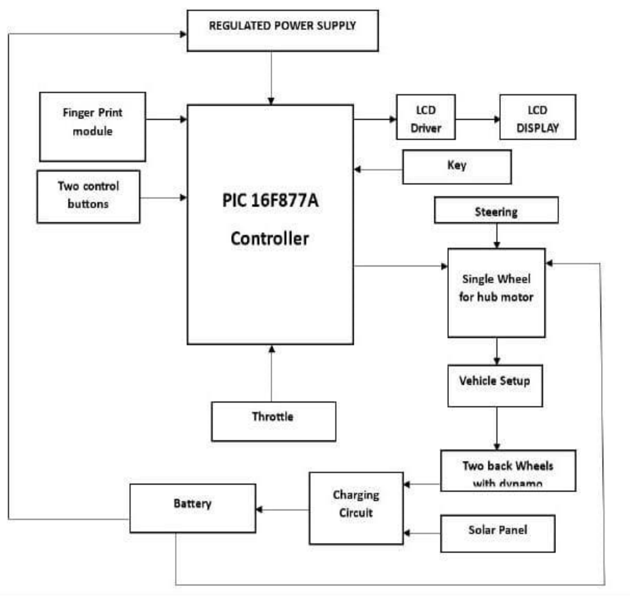


Fig 1: Block Diagram of solar and dynamo powered EV using fingerprint authentication

Two control buttons are attached to the microcontroller, which has both an enabling and a formatting pin. We can save fresh user fingerprints by using the enabling pin. The formatting pin will reformat all previously saved data.

LCD Driver is an integrated circuit that connects a microcontroller and an LCD display. The LCD display will offer information about the vehicle's fingerprints, speed, and voltage.

When the ignition is turned on, signals are transmitted through the controller to the hub motor's wheel, causing the vehicle to start. The charging circuit is supplied with solar energy and dynamo power. The battery is simultaneously charged in a charging circuit, allowing the battery to store energy. From the battery back to the supply. To start the EV, the hub motor receives power from the battery.

V. CIRCUIT DIAGRAM & WORKING

Circuit Diagram:

The PIC 16F877A microcontroller has forty pins. The PIC16F877A is Microchip's 8-bit microcontroller. It contains 33 IO lines, 8 10-bit ADC pins, and 8K of programme space. It operates at a maximum speed of 20 MHz and can be programmed in circuit.42V to 5.5V is the voltage range.

Each port can sink up to 100 mA. The microcontroller is the project's key component; it sends signals to other components to allow them to function. Each pin of the controller is connected to a distinct hardware component, as shown in the circuit diagram. The table depicts the connections between the

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 9
***Article Received:** 29 September 2023 **Revised:** 13 November 2023 **Accepted:** 27 November 2023*

hardware components:

PINS	COMPONENTS
Pin 1	Reset and Ground
Pin 2(RA0/AN0)	Dynamo, solar panels, battery through Voltage sensor
Pin4	Throttle
Pin 8	Fingerprint
Pin 13,14	Crystal Oscillator
Pin 15	Hub motor through transistor circuit
Pin 22,21	Control Buttons
Pin 23	LED
Pin 27	Key
Pin 35-40(RB2-RB7)	LCD

Table 2: List of pins connected to Microcontroller

Working:

To start the tricycle, we must first insert the key and then the finger print. We installed an enabling key to save fingerprints. If the fingerprint has already been stored, the LCD will read "please place the finger"; otherwise, it will read "fingerprint accessed, please takeoff" and allow you to proceed with the takeoff. If not, we will need to turn the key on and off to see if it still matches.

The battery will be charged from three distinct sources. It takes roughly three hours to fully charge the two dynamos connected in series at the wheel location. There are four 12-volt batteries in use. These are connected in series, as is the power supply provided by the MCB to the controller. It will take three hours to fully charge the battery. We have 20-watt solar panels coupled to 24-volt batteries.

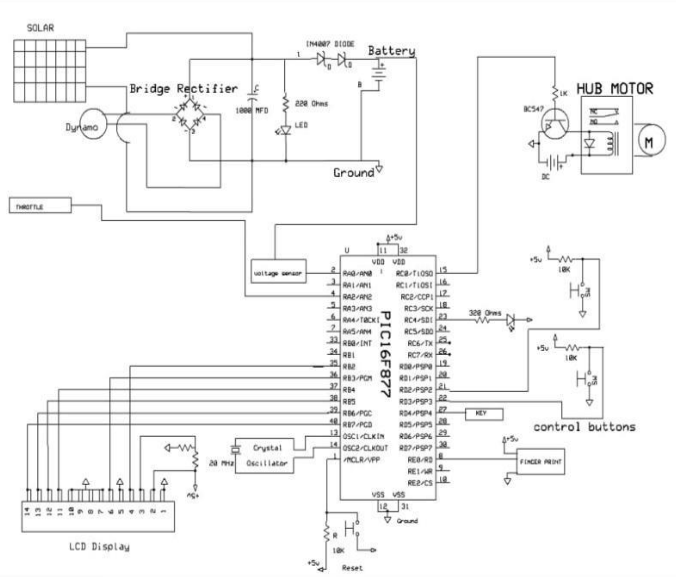


Fig 2: Schematic Diagram of solar and dynamo powered EV using Fingerprint authentication.

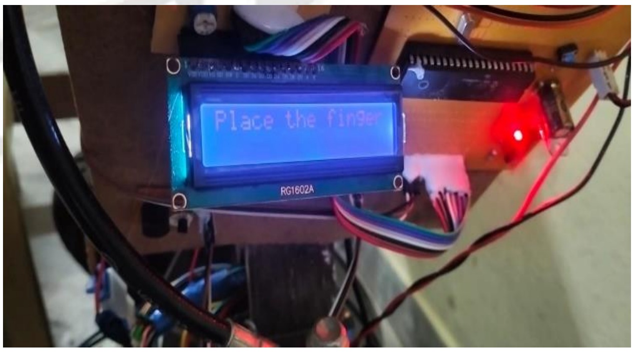
Furthermore, the throttle fed input into the controller, which controlled the hub motor. HUB Motor operates at 35 km/h with a voltage of 48 or 80 watts. The vehicle can transport weights of up to 80 kg.

While charging, the battery will display a red light. When fully charged, it will display a green light. In addition, we are using two chargers: charger 1 is attached to the solar panel's output, while charger 2 is connected to the dynamo's output. For security reasons, we use MCBs. To prevent further damage to the vehicle in the event of a heavy load. We utilize MCB. Batteries are charged using solar and dynamo power. The microcontroller will use battery energy to provide signals to power the hub motor.

The voltage sensor and crystal oscillator are connected to the relay's other end via the microcontroller's A10, A11, and A12 pins, which are attached to the three relays. Crystall oscillator tell the microcontroller about what instructions should be taken by the user. The temperature of the battery is measured with a temperature monitor (Lm35). This sensor is used to measure the temperature of the battery during the charging and discharging process. When the temperature of the battery reaches 50 degrees, a buzzer system alerts and delivers a signal via buzz sound. This sensor is attached to the microcontroller's pins. The lcd displays the voltage and temperature of the batteries.

Furthermore, the hub motor powers the vehicle's front wheels. When sunlight is sparse during the rainy or windy season, a dynamo is employed to recharge the batteries. This is one of our project's key advantages.

VI. OUTPUT



International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 9
***Article Received:** 29 September 2023 **Revised:** 13 November 2023 **Accepted:** 27 November 2023*

Fig 3: Output of solar and dynamo powered EV using Fingerprint authentication.

VEHICLE SPECIFIACTIONS AND RANGE

VALUE OF TORQUE	- 35N-m
CHARGING TIME	- 3 HOURS
MAXIMUM SPEED OF VEHICLE	- 35Km/hr
RANGE IN ONE SINGLE CHARGE	- 30Km
WEIGHT CARRYING CAPACITY	- 80Kg

VII. CONCLUSION

This initiative tries to make the standard electric vehicle more efficient. To work properly, electric vehicles (EVs) require two types of battery charging: sun and dynamo. Solar power sources cannot operate during rainy weather due to a lack of sunshine. Fortunately, this electric car features a self-charging dynamo to recharge its battery. We boosted the security of electric vehicles by using fingerprints to activate the ignition. If the fingerprint matches the image saved in the database after being converted to binary, the electric vehicle's ignition will start. If the image stored in the database does not match the fingerprint, the electric vehicle will not start. It detects the voltage, temperature, and speed of the battery on the LCD display.

VIII. FUTURE SCOPE

We aim to install a cabin in the back to transport stuff and improve the vehicle's efficiency.

REFERENCES

[1] Rajan Verma, ―Designing and Fabrication of Hybrid Bicycle‖, International Journal of Engineering Science and Computing, volume 6, issue No. 5, Page No.5212-5215, May 2016.

[2] Gomis Chawla, ParmjeetKaushik, Rajat Singhal: Design and Fabrication of a Tadpole Hybrid Trike. International Journal of Aerospace and Mechanical Engineering, Volume 3 – No.1, February 2016.ISSN (O): 2393-8609.

[3]Matteo Corno; Daniele Berretta; Pier Francesco Spagnol; Sergio M. Savaresi, "On the Design, Control, and Validation of a Charge-Sustaining Parallel Hybrid Bicycle",
IEEE Tran, Vol 24, pp 817 – 829, May 2016.

[4] Priscilla Mulhall; Srdjan M. Lukic; Sanjaka G. Wirasingha; Young-Joo Lee; Ali Emadi, "On Solar-Assisted Electric Auto Rickshaw Three-Wheeler", IEEE Tran, Vol 59,
pp 2298 - 2307, March 2010.

[5] Bhuiyan; Mohammad; Zaima;Khosru M Salim; "Feasibility Study of a Partially Solar Powered Electrical Tricycle in Ambient Condition of Bangladesh", 4th International Conference on Electrical Engineering and Information & Communication Technology , September 2018

[6] M. Amrhein, P.T. Krein, Dynamic simulation for analysis of hybrid electric vehicle system and subsystem interactions, including power electronics, IEEE.

[7] Hayashi; Yoshihiko, **"**Development of Small Compact Electric Motor Tricycle for shopping**",** International Conference on Control, Automation and Systems, December 2014, ISSN**:** 2093-7121.

[8] Priscilla Mulhall;Srdjan M. Lukic;Sanjaka G. Wirasingha;Young-Joo Lee;Ali Emadi, "Feasibility Study of a Partially Solar Powered Electrical Tricycle in Ambient Condition of Bangladesh", IEEE Transactions on Vehicular Technology, vol 59, pp 2298 – 2307,June 2010.

[9] Schuss; Apio;Bernd Eichberger;Timo Rahkonen , "Impacts on the Output Power of Photovoltaics on Top of Electric and Hybrid Electric Vehicles", IEEE Transactions on Instrumentation and Measurement, Vol 69, pp 2449 – 2458, May 2020.

[10] Jia-Sheng Hu;Fei Lu;Zhu; Chang-Yi; Sin-Li;Tsai-Jiun Ren;Chunting Chris Mi, "Hybrid Energy Storage System of an Electric Scooter Based on Wireless Power Transfer", IEEE Transactions on Industrial Informatics Vol 14, Pp 4169 – 4178, September 2018.

[11] G. Gaswin Kastro;Vincent Jain, "Solar powered tricycle for fish vending women", IEEE Region 10 Conference, ISSN: 2159-3450, December 2017.

[12] Arya; Mahi;V. Karthikeyan, "An IoT Enabled Electric Tricycle Monitoring System", IEEE Students Conference on Engineering & Systems (SCES),November 2020