

Biometric Authentication Based Management For E-Bike Sharing System

S Amarnath, R Muralitharan, R Robinson, M Vijay Sanmugam, M P E Rajamani

Abstract: Our project aimed to provide a mobility system for E-bikes to make urban mobility affordable and non-pollutable thus providing service through the secure mode of transportation for the urbanites and in closed environments like universities and IT parks. A fingerprint-based biometric system of authentication for E-bikes to enhance micro-mobility among the targeted audiences. Compared to other systems of authentication, fingerprint-based authentication is unique, highly accurate and an economical technique. An account can be created using personnel data and unique ID will be assigned to each individual's fingerprint. By database management system, the user can be identified, tracked and the user can also check his account and the amount for the usage-based on time is deducted from the account in the form of minutes. The web-based application notifies regarding account recharge which shows minutes. The security of the system is ensured via GPS and GSM. GPS based security ensures the vehicle becomes inoperable outside the area formulated by the service provider. This sends the system information to the web-based mobile application. This project encourages the urbanities to use E-bikes to commute affordable and eco-friendly.

Index Terms: Automobile Security, Biometric authentication, Fingerprint sensor, GPS and GSM technology, Vehicle sharing.

1 INTRODUCTION

Transportation carries its importance in communication, economic growth, globalization, trade and other forms of exchanges. It also has greater importance in the routine life of people. Roadways, Railways, and Airways are the major source of transportation. The people's choice of transport depends on distance, time, cost and other needs. Road transport is mainly preferred by the commuters because it reaches every nook and corner of the country. Bus Transport serves last mile connectivity in mass transportation and takes the public to the nearest location of their final destination. Passenger Buses are the lifeline of transportation of every state government. Chennai city is stunned by accelerating the growth of private individual vehicles. Statistics from the Department of State Transport shows that Chennai city has around 42 lakhs two-wheelers and 88 lakhs cars. The number of vehicles arises with many problems such as congestion and air pollution. The bus mode of transportation does not support the first mile and last-mile connectivity. People prefer individual rental cars. The price of those rental vehicles is comparatively higher than the bus and train. Customers can be satisfied with rental bikes. So that the customer who commute may able to travel from first to the last mile of his journey. The use of individual petrol and diesel vehicles can be reduced. Biometrics is defined as the process of identification of individuals related to physiological characteristics for authentication purposes. Biometric technologies include recognition of bio-information such as the face, fingerprint, iris, voice and signature recognition.

Biometrics technology has its applications in military and aviation and has been introduced as an authentication system for sensors and touch IDs of digital devices themselves. The advancement of communication along with information technology has expanded the range of applications using biometrics technology. Therefore, security using biometric technology is more secure compared to other authentication technology. A fingerprint-based biometric system of authentication is secured by a security system comprising GPS and GSM. Through the security setup, the service provider will be able to configure the area outside in which the vehicle becomes inoperable.

2 EXISTING SYSTEM

The vehicle starting system using fingerprint was proposed by V.Nandagopal. It explains the starting of the vehicle based on a fingerprint scan. This proposed system has the drawback that it has no mechanism to store user information and user details. Intelligent Anti-Theft and Tracking System for Automobiles was proposed by N.Ramadan describes a low-cost vehicle tracking and monitoring that tracks the location of the vehicle and sends it to the service provider and if the same wants to lock the vehicle, the SMS can be sent to stop the vehicle. This proposed system has the disadvantage that the service provider needs to monitor the vehicle regularly. Android mobile application for the cycle sharing system was proposed by Parvathy Krishna. G. The proposed system uses barcode and QR code for authentication.

3 PROPOSED SYSTEM

The proposed system aimed to provide a mobility system for E-bikes to make urban mobility affordable and non-pollutable thereby providing service secured mode of transportation for the urbanites. It has two subsystems. One for authentication and then another for a security system. Biometric-based authentication is used for accessing the vehicle. Once the fingerprint sensor recognizes the valid fingerprint, the electronic lock is released through the relay device and the time stamp gets noted and the electronic lock gets closed once the same fingerprint is recognized and the timestamp is noted. The difference in timestamps is calculated and the minutes are deducted from the account

- S Amarnath, R Muralitharan, R Robinson, M Vijay Sanmugam is currently pursuing a bachelor's degree program in electrical and electronics engineering at National Engineering College, PH-9688409922. E-mail: amaramarnath2011@gmail.com
- Rajamani M P E is currently Assistant Professor (Sr. Gr) in National Engineering College, Kovilpatti, Tamilnadu, India, E-mail: mpereee@nec.edu.in

and the user is notified by the SMS. The Service provider can configure the area. The vehicle gets locked outside the area. Once the vehicle is ridden outside the zone, then the vehicle is locked and the service provider is informed through SMS. The vehicle can be tracked through a web-based mobile application. An account can be created using personnel data and unique ID will be assigned to each individual's fingerprint. The user can also check his account. The user can recharge his minutes in the account. The user is notified when the minutes fall below the threshold level through SMS. The service provider can see the usage of the user and thus the security of the vehicle can be ensured. About the software work of the system, it has two parts. One for enrolling a fingerprint when the account is created and another one for recognizing the fingerprint for usage. The second part of the software side also has the work to calculate the usage time for each user. All user information such as name, ID, usage, minutes is stored in the cloud.

4 WORKING DIAGRAM

The block diagram and flowchart of the working model is shown in Fig. 1 and Fig. 2 respectively. The block diagram shows the main components of the system. The flowchart shows the working sequence of how the vehicle gets unlocked and also shows the flow of system security. The power supply set up can be provided from either vehicle battery or by using a dedicated power supply.

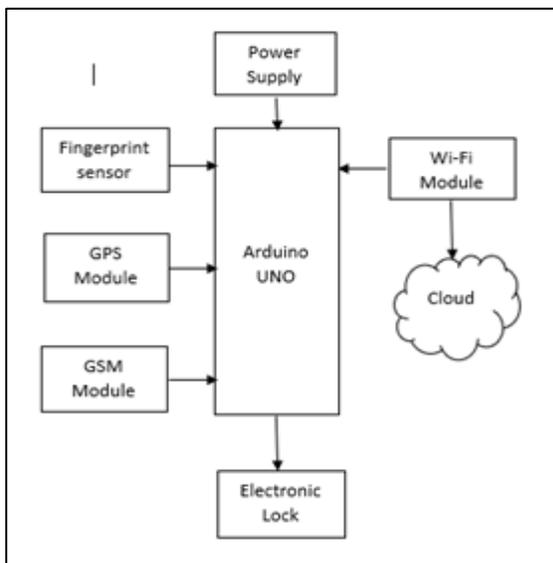


Fig. 1 Block Diagram of the proposed system

The flowchart gives the sequence of operations excluding cloud and initial set up process. The timestamp difference is taken into account for the fare calculation and is deducted in terms of minutes from the account. The timestamp of entry and exit based on the fingerprint sensor also update in the database. The process of enrolling the fingerprint and creating an account can be done in person by visiting the centers allotted. For the prototype purpose simple database alone used and travel, data are retrieved using the database queries like select, update and delete.

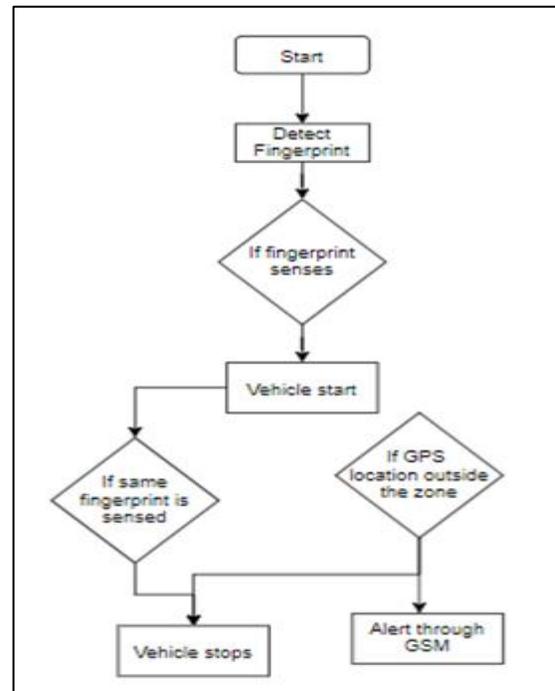


Fig. 2 Flowchart of the proposed system

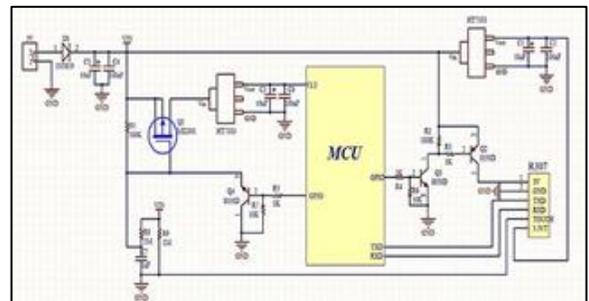
5 HARDWARE COMPONENTS

The required components and facilities for the proposed system is listed below

1. Fingerprint sensor module
2. Arduino UNO
3. GPS module
4. GSM module
5. Wi-Fi module
6. Power source

5.1.1 Fingerprint sensor module

Fingerprint scanners are security systems of biometrics. It is an electronic device used to capture and analyze a digital image of the fingerprint pattern. This module has a capacitive fingerprint scanner which is used to generate an image of the ridges and valleys that make up a fingerprint. Instead of sensing the fingerprint using light, the capacitors use electrical current. The R307 Fingerprint Module was used in our project. Digital signal processors (DSPs) is used to process electrical signals generated by electronic sensors (e.g., cameras, fingerprint sensors, microphones, etc.,)



5.1.2 Working of sensor module

The four basic elements of a typical biometric system are sensing, processing, storage, and interface to an existing biosensor module.

5.1.3 Sensing element

The Sensing element or the input interface element is the hardware core of a biometrics system and converts human biological data into digital form. optical sensor is used in fingerprint systems. These sensors capture the biometric information and convert it into a digital form. The sensor is made up of semiconductor chips with an array of tiny cells. Each cell contains two conductor plates, covered with an insulating layer.

5.1.4 Processing element

The processing element is generally a processor such as a microprocessor, that processes digital signal captured from the sensors. The biometric fingerprint image can be processed in the following ways such as image enhancement, normalization, template extraction, and matching/comparison of that biometric template during enrollment and authentication of the users. The DSP architecture is used to support complex mathematical algorithms that involve a significant amount of multiplication and addition. The DSP executes the multiply/add functions in a single cycle (compared to multiple cycles for RISC processors) inside the arithmetic logic unit (ALU) with the help of the multiply/accumulate (MAC) hardware.

5.1.5 Storage element

The function of the storage element is to store the enrolled template that is recalled to perform a match program at the time of authentication. The storage element generally is random access memory (RAM) or flash EPROM or some other form of memory IC.

5.1.6 Interface element

The output interface element, which is used to communicate the decision of the fingerprint biometric system to the interfaced asset to enable access to the user with a simple serial communication protocol.

5.1.7 Specifications

- Have a well-designed fingerprint algorithm, with high capacity flash chips.
- Simple structure with fingerprint entry, image processing. The module also used for fingerprint matching search and Template storage.
- Have inbuilt storage capacity. The storage capacity of the module is 1000 templates.
- Ultralow level power Consumption. Security levels can be adjusted for different applications.
- The interface can be made with UART (TTL Logic level) or USB 2.0.
- Working Environment of this device should be between -10°C- 40°C.
- Finger touch-sensing signal output, sensing circuit standby current is Very low, less than 5uA.
- Suitable for fingerprint locks, fingerprint safes, and other purposes.

5.2 ARDUINO UNO

Arduino Uno is a microcontroller board made up of an 8-bit ATmega328P microcontroller. Along with this, it consists of other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack port, and a reset button.

5.2.1 Features

The operating voltage and input voltage of Arduino are 5V and 7-12V. It has 14 Digital pins and 6 Analog pins.

5.3 Global Positioning System (GPS) Module

The Global Positioning System (GPS) is the Global Navigation System. GPS uses a GPS receiver (HOLUX GR-67 series.) to determine their location, speed, direction, and time to the user. A GPS receiver receives the signals from satellites to calculate latitude and longitude position and also to compute its three-dimension (latitude, longitude, and altitude) position. Therefore, GPS is a key technology for giving the position of a particular object. It allows users to determine their exact location in all external conditions all around the world. It is generally used to track any vehicles and to make the best route from one place to another places. It can be classified into three distinct segments. such as Space, Control and User segment. The Space Segment refers to satellites and there are about 24 satellites distributed in six orbital areas, Control Segment refers to the stations to maintain and monitor the satellites and User Segment process the navigation signals received from the GPS satellites to calculate position and time for the user.

5.4 Global System for Mobile (GSM) Module

A GSM modem is a special type of modem which accepts a SIM card and operates over a subscription to a unique mobile operator. GSM (Global system for mobile) uses a process or proposed method called circuit switching. This method of communication is established between any two devices. Once the two devices are connected, a constant stream of digital data is transmitted. GSM networks consist of three major systems such as the Switching System, the Base Station (BSS) and the Mobile station (MS).

5.5 Wi-Fi MODULE

The Wi-Fi module as shown in fig 7 which is used to access the Wi-Fi network. By these Wi-Fi modules, we will connect the cloud with the system in the buses.

6 CONCLUSION

The proposed system encourages the commuters to use E-bikes alternative to petroleum-based vehicles. The system encourages a rental method of vehicle. The vehicle security can be ensured with the proposed system. The project can be extended in the future with machine learning and deep learning technologies for the machine to machine communication so that the mass sharing of vehicles can be encouraged. This can also be extended to the process of carpooling. The fingerprint-based authentication is unique, highly accurate and an economical technique so it can be a great idea to implement in the urban cities.

7 REFERENCES

- [1] N. Ramadan et al, "Intelligent Anti-Theft and Tracking System for Automobiles", International Journal of Machine Learning and Computing, Vol. 2, No. 1, February 2012.
- [2] Dr.V. Nandagopal et al, "Vehicle starting system using finger print", International Journal of Pure and Applied Mathematics, Volume 119 No. 18 2018.
- [3] Parvathy krishna. G, Ramya. S & T. Subha, "Android mobile application for cycle sharing system", International Journal of Mechanical and Production Engineering Research and Development, Vol. 8, Special Issue 3, Dec 2018
- [4] Mohammed Yousufbaba Moinuddin, "Real Time Biometric Based Vehicle Security System with GPS and GSM Technology", IJESC Volume 7 Issue No.3 2017
- [5] G. Srikanth et al, "Biometric Vehicle Access System Using Fingerprint Recognition", IJRASET Volume 5 Issue VII, July 2017.
- [6] "Secure Biometric-Based Authentication Protocol for Vehicular Ad-hoc Network", IEEE International Symposium on Smart Electronic Systems - Md Ismail Research Center Imarat DRDO, 2018.
- [7] C.O. Folorunso et al, "Design and Development of Fingerprint based Car Starting System" International Conference and Exhibition on Power and Telecommunications (ICEPT), 2015.