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Advanced Biometric Authentication System in Two Wheeler

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Abstract— This project is to develop an authentication system on two-wheelers based on biometric that can be used to secure the two-wheeler from theft. This project will utilize a fingerprint scanner as the input to acquire fingerprint images and to ignite the system. When fingerprint is scan on fingerprint scanner, fingerprint images will be sent into database and will be match with stored data. This project is also need to develop programs that fingerprint recognition and identification function as well as database to store the fingerprint images. In the database there will be a lot of information about the fingerprint such as fingerprint pattern, fingerprint classification, fingerprint identification, fingerprint reference point and others. All of this is to match the input fingerprint images with the fingerprint images in the database. These eliminate the need for keeping track of keys. It can only be opened when an authorized user is present, since there are no keys or combinations to be copied or stolen, or locks that can be picked. In this project the fingerprint module from Maxis Biometrics is used. It can store up to 768 finger prints on its own memory. The microcontroller AT89S52 interacts with the module. You can add a fingerprint, delete a fingerprint and identify the fingerprint. To identify the finger, press the Identify button and if the finger matches then the Relay is complemented. Also the fingerprint ID is displayed over the LCD display. LCD is displaying the speed and distance travelled by vehicle.

I. INTRODUCTION

Biometric system can be either an 'identification' system or a 'verification' (authentication) system. The terms “Biometrics” and “Biometry” have been used since early in the 20th century to refer to the field of development of statistical and mathematical methods applicable to data analysis problems in the biological sciences. Recently, the term “Biometrics” has also been used to refer to the emerging field of technology devoted to identification of individuals using biological traits, such as those based on retinal or iris scanning, fingerprints, or face recognition.

Identification - One to Many: Biometrics can be used to determine a person's identity even without his knowledge or consent. For example, scanning a crowd with a camera and using face recognition technology, one can determine matches against a known database.

Verification - One to One: Biometrics can also be used to verify a person's identity. For example, one can grant physical access to a secure area in a building by using finger scans or can grant access to a bank account at an ATM by using retinal scan.

II. CIRCUIT DESCRIPTION & IMPLEMENTATION

In this project we use AT89S51 belongs to Atmel 8051 family. It has four ports. Port 0 is the bidirectional I/O port. It used as a multiplexed address/data bus. It has 8 pins. These 8 pins are connected with data lines of LCD. The port 0 wants external pull ups when program verification. Port 1 is also a bidirectional I/O port. It is used as standard I/O function. The relay and the search key also connected with the port 1.The control lines of LCD RS, R/W, and EN are connected with port 1. Port 2 receives the higher order bytes when read cycle. So we use side stand key in this port. Port 3 is used for special functions. The fingerprint module is connected with RXD and TXD pins. In port 3, opto-coupler is connected for accuracy purpose and also to isolate the input and output circuits. The EEPROM is connected with port 3 to store the fingerprints, speed and also the details of user and the vehicle. The output of the transistor relays gives to the Darlington array output is given to two relays. Relay 1 is for fuel cut off at over speed. For this the servo valve is added to motor. While the speed exceed the normal speed the valve stop the fuel flow then the vehicle get stop. The relay 2 is for ignition purpose. If the user’s fingerprint and the already stored fingerprint get matched the relay is activated and the vehicle is ignited. Power Suppl A switched-mode power supply is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. And transfers the DC supply to the circuit in a various range (such as +5V, +12v…). A linear regulator [7805 & 7812] provides the desired output voltage by dissipating excess power in ohmic losses. A linear regulator regulates either output voltage or current by dissipating the excess electric power in the form of heat, and hence its maximum power efficiency is voltage-out/voltage-in since the volt difference is wasted. In

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contrast, a switched-mode power supply regulates either output voltage or current by switching ideal storage elements, like inductors and capacitors, into and out of different electrical configurations, Ideal switching elements.

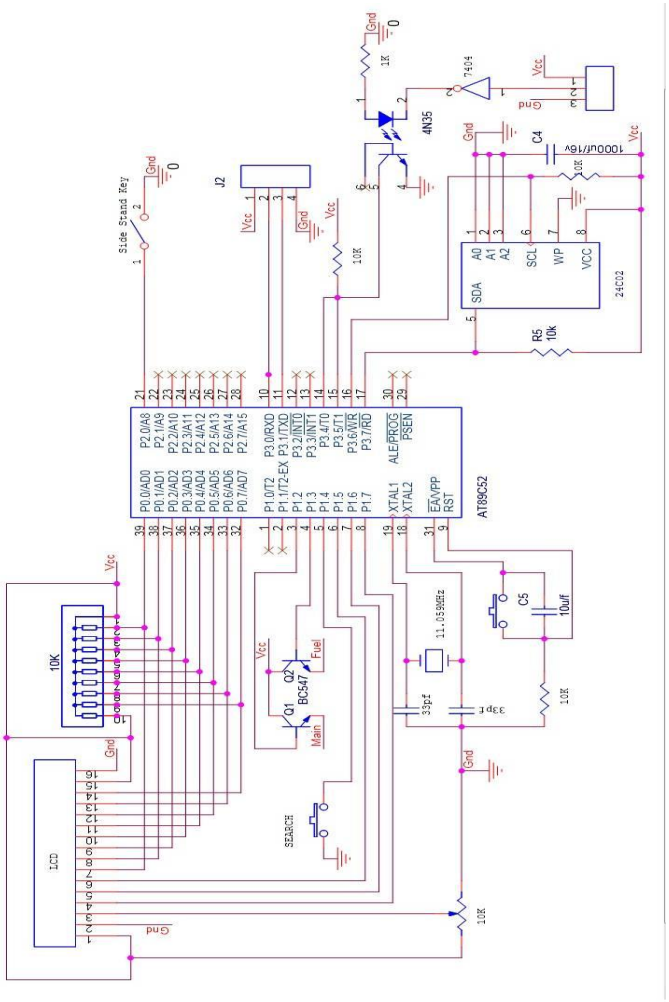

Fig. 1: Circuit Description

III. FINGERPRINT ALGORITHM

A. Fingerprint Module

SM630 background highlight optical fingerprint verification module is the latest release of Miaxis Biometrics Co., Ltd. It consists of optical fingerprint sensor, high performance DSP processor and Flash. It boasts of function such as fingerprint login, fingerprint verification, fingerprint deletion, fingerprint upload, fingerprint download, etc.

B. Fingerprint algorithm

Miaxis owns fingerprint verification algorithm with self-independent IP and gains several national invention patents. Miaxis algorithm has the below three generations according to the realization theory.

1) Minutiae-based Fingerprint Matching Algorithm.
2) Ridge-based Fingerprint Matching Algorithm.
3) Image-based Fingerprint Matching Algorithm.

Three algorithms have their respective advantages and meet the different needs of applications.

Miaxis algorithm has the following characteristics:

1) Intellectualized

Intelligent image processing as human thinking way, faithfully deliver the original fingerprint image

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characteristics, effectively sort the characteristics and ensure its differentiability, stability and independency.
2) Small Volume
Code length of Miaxis algorithm is less than 48KB, data buffer less than 16KB, and the memory demand is less than 64KB, it is the most reduced fingerprint verification algorithm in the world.
3) Rapid Speed
Miaxis algorithm just needs 60 MIPS. To process and verify a 64KB fingerprint image, it can affect the fingerprint verification easily on all normal processor platforms.
4) High Portable Ability
Miaxis algorithm adopts standard C Language which is easily porting in different platform. At present, Miaxis algorithm has been widely used in DSP, ARM etc. embedded platform, and Windows, UNIX, LINUX etc. operation system.

The analysis of fingerprints for matching purposes generally requires the comparison of several features of the print pattern. These include patterns, which are aggregate characteristics of ridges, and minutia points, which are unique features found within the patterns. It is also necessary to know the structure and properties of human skin in order to successfully employ some of the imaging technologies.

Fingerprint matching, among all the biometric techniques, fingerprint-based identification is the oldest method which has been successfully used in numerous applications. Everyone is known to have unique, immutable fingerprints. A fingerprint is made of a series of ridges and furrows on the surface of the finger. The uniqueness of a fingerprint can be determined by the pattern of ridges and furrows as well as the minutiae points. Minutiae points are local ridge characteristics that occur at either a ridge bifurcation or a ridge ending.

Fingerprint matching techniques can be placed into two categories: minute-based and correlation based. Minutiae-based techniques first find minutiae points and then map their relative placement on the finger. However, there are some difficulties when using this approach. It is difficult to extract the minutiae points accurately when the fingerprint is of low quality. Also this method does not take into account the global pattern of ridges and furrows. The correlation-based method is able to overcome some of the difficulties of the minutiae-based approach. However, it has some of its own shortcomings. Correlation-based techniques require the precise location of a registration point and are affected by image translation and rotation.

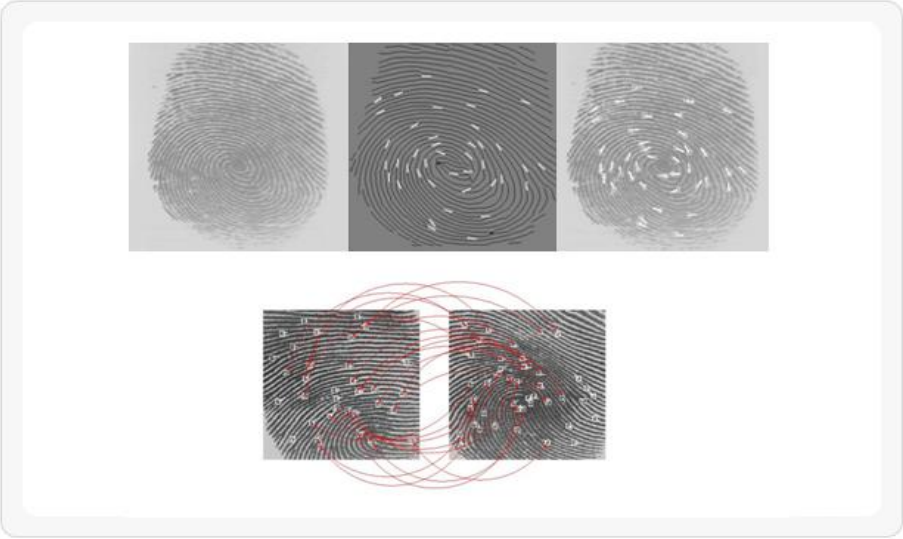

Fig 2: Finger Print Comparison

Fingerprint matching based on minutiae has problems in matching different sized (unregistered) minutiae patterns. Local ridge structures cannot be completely characterized by minutiae. We are trying an alternate representation of fingerprints which will capture more local information and yield a fixed length code for the fingerprint. The matching will then hopefully become a relatively simple task of calculating the Euclidean distance will between the two codes. We are developing algorithms which are more robust to noise in fingerprint images and deliver increased accuracy in real-time. A commercial fingerprint-based authentication system

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requires a very low False Reject Rate (FAR) for a given False Accept Rate (FAR). This is very difficult to achieve with any one technique. We are investigating methods to pool evidence from various matching techniques to increase the overall accuracy of the system. In a real application, the sensor, the acquisition system and the variation in performance of the system over time is very critical. We are also field testing our system on a limited number of users to evaluate the system period of time.

Fingerprint Classification, Large volumes of fingerprints are collected and stored every day in a wide range of applications including forensics, access control, and driver license registration. An automatic recognition of people based on fingerprints requires that the input fingerprint be matched with a large number of fingerprints in a database (FBI database contains approximately 70 million fingerprints!). To reduce the search time and computational complexity, it is desirable to classify these fingerprints in an accurate and consistent manner so that the input fingerprint is required to be matched only with a subset of the fingerprints in the database. Fingerprint classification is a technique to assign a fingerprint into one of the several pre-specified types already established in the literature which can provide an indexing mechanism. Fingerprint classification can be viewed as a coarse level matching of the fingerprints. An input fingerprint is first matched at a coarse level to one of the pre-specified types and then, at a finer level, it is compared to the subset of the database containing that type of fingerprints only. We have developed an algorithm to classify fingerprints into five classes, namely, whorl, right loop, left loop, arch, and tented arch. The algorithm separates the number of ridges present in four directions (0 degree, 45 degree, 90 degree, and 135 degree) by filtering the central part of a fingerprint with a bank of Gabor filters. This information is quantized to generate a Finger Code which is used for classification. Our classification is based on a two-stage classifier which uses a K-nearest neighbour classifier in the first stage and a set of neural networks in the second stage. The classifier is tested on 4,000 images in the NIST-4 database. For the five-class problem, classification accuracy of 90% is achieved. For the four-class problem (arch and tented arch combined into one class), we are able to achieve a classification accuracy of 94.8%. By incorporating a reject option, the classification accuracy can be increased to 96% for the five-class classification and to 97.8% for the four-class classification when 30.8% of the images are rejected.

The major Minutia features of fingerprint ridges are, ridge ending, bifurcation, and short ridge (or dot). The ridge ending is the point at which a ridge terminates. Bifurcations are points at which a single ridge splits into two ridges. Short ridges (or dots) are ridges which are significantly shorter than the average ridge length on the fingerprint. Minutiae and patterns are very important in the analysis of fingerprints since no two fingers have been shown to be identical.

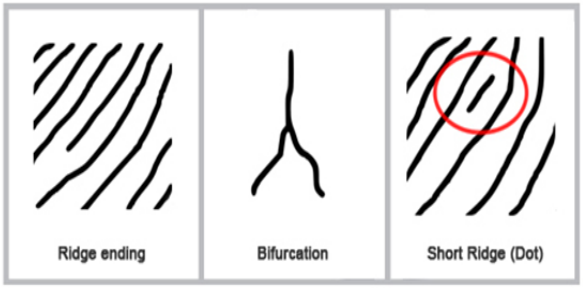

Fig 3: Image Processing Algorithm

IV. MICROCONTROLLER

A microcontroller consists of a powerful CPU tightly coupled with memory (RAM, ROM or EPROM), various I/O features such as serial port(s), parallel port(s), Timer/Counter(s),Interrupt controller, Data acquisition interfaces- Analog to Digital converter(ADC), Digital to Analog converter(DAC), everything integrated onto a single silicon chip. Depending on the need and area of application for which it is designed, the chip on features present in it may or may not include all the individual sections.

In our project we use Atmel AT89S51 eight bit microcontroller with 4k bytes in system programmable flash. The AT89S51 is a low power, high performance CMOS 8 bit microcontroller with 4k bytes of in-system programmable flash memory. The device is manufactured using Atmel's high density non-volatile memory technology and it is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip flash

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allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining versatile 8 bit CPU with in-system programmable flash on a monolithic chip, the Atmel AT89S51 is a powerful microcontroller which provides a highly flexible and cost effect solution to many embedded control applications.

V. EEPROM

AT24C02 is an electrically erasable and programmable ROM. It has a 2Kbits of memory size arranged in 32 pages of 8 byte each. There are 256 (32 x 8) words each of one byte. The data is transferred and received serially through serial data (SDA) pin.

The SCL is clock input and is used to synchronize EEPROM with microcontroller for various operations. When data is to be read or write, first a start condition is created followed by device address, byte address and the data itself. Finally a stop condition is provided. The start condition occurs when SDA and SCL get high to low simultaneously. The stop condition is when SDA remains low while SCL goes from high to low. The data is read or written between the start and stop conditions on every transition of SCL from high to low. A total of eight EEPROMs can be connected through a bus. There are three address pins in AT24C02 for selecting a particular chip. The device can be addressed serially by the software. It makes use of an internal register of the EEPROM whose 4 MSB bits are 1010, the next three are the EEPROM address bits and the LSB signifies whether data is to be read or written. This last bit is 1 for write and 0 for read operation

It also have limited life that is, the number of times it could be reprogrammed was limited to tens or hundreds of thousands of times. The limitation was extended to a million write operations in modern EEPROMs.

A. RPM Sensor

In this project to measure the Revolution per Minute (RPM) of the vehicle we use "Continuous Ratio-metric Linearly Hall effect sensor". The benefit of using Hall Effect sensor is it could be entirely integrated on a single silicon chip. This breakthrough resulted in the low cost, high volume application of Hall Effect, truly solid state keyboards. Micro Switch sensing and control has produced and delivered nearly a billion Hall Effect devices in keyboards and sensor products.

B. Circuit description

This circuit is designed to control the load. The load may be motor or any other load. The load is turned ON and OFF through relay. The relay ON and OFF is controlled by the pair of switching transistors (BC 547). The relay is connected in the Q2 transistor collector terminal. A Relay is nothing but electromagnetic switching device which consists of three pins. They are Common, Normally close (NC) and normally open (NO). The relay common pin is connected to supply voltage. The normally open (NO) pin connected to load. When high pulse signal is given to base of the Q1 transistors, the transistor is conducting and shorts the collector and emitter terminal and zero signals is given to base of the Q2 transistor. So the relay is turned OFF state. When low pulse is given to base of transistor Q1 transistor, the transistor is turned OFF. Now 12v is given to base of Q2 transistor so the transistor is conducting and relay is turned ON. Hence the common terminal and NO terminal of relay are shorted. Now load gets the supply voltage through relay.

C. Applications

- ✓ For Anti-theft
- ✓ To measure RPM of the vehicle
- ✓ Side stand indication
- ✓ Fuel cut-off system at over speed

D. Advantages

- ✓ Biometric is used to accomplish the anti-theft.
- ✓ It is compact ability in all models
- ✓ Ease of use
- ✓ To reduce the accidents due to over speed

VI. RESULT AND DISCUSSION

Fingerprint module used for the secure ignition and authentication purpose in two-wheeler from anti-theft. Display seems the speed and distance travelled by a vehicle, the relay is driven from the output of ULN2803 driver

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chip. The microcontroller monitors the all sequences and simultaneously speed of the vehicle is measured and control signal is given to the relay driver Since by the main objective of the project is accomplished successfully but here DC motor is used instead of servo valve in order to show the dummy model of fuel ignition system of two wheeler. As described above model the little drawback is obtained, which is less sample output but this project is very suitable for the real-time application.

VII. CONCLUSION

Now-a-days thefts and accidents are increasing. To prevent from these problems this project is used. The theft is controlled by the fingerprint matching process. Then the accidents are prevented by side stand indication and fuel cut off due to over speed. In future this project can be expanding for four wheelers with Palm recognition also. In this project we can add GPS to trace the vehicles exact location. To implement more number of operation and to get high throughput higher versions of controller can be selected.

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