Antitheft Biometric Padlock

Aishawarya Ravindra Joshi[1], Deepanjali Ravaji Kadlag[2], Kirti Mohanlal Wakhare[3], Vrushali Rajendrasa Wakhare[4], Prof. R.G.Zope[5]

[1,2,3,4,5](E & TC Department, SRES, COE, Kopargaon/ SPPU, India)

Abstract: *The proposed work is fine combination of "Biometrics technology" and "Embedded system technology". In this paper the work focuses on padlock without any key or password, moreover the padlock will scan the fingerprint of the user and provide security. It can scan up to 5 fingerprints using fingerprint sensor R300. If anyone tries to open the lock he/she will scan the fingerprint. The ATmega 328p controller will compare it with the stored database then the lock will open otherwise one can get 4 more chance to scan the fingerprint. Still if it does not match then keypad will become activate and One Time Password (OTP) will be provided to the user through Global System for Mobile (GSM). This OTP will be entered by user and lock will open. This system is more secure because if any thief tries to cut the lock at that time it will sense the vibrations and gives signal to controller and will alert the user by sending message as well as audio indication through buzzer.*

Keywords: *Fingerprint, ATmega, OTP, GSM.*

I. Introduction

In our day-to-day busy lifestyle we have to keep records of many things. Such as password of mobile, Automatic Teller Machine (ATM) etc. As well as one has to maintain many things like keys of bicycle, car, house, etc. But if any key is missed then it will be difficult to obtain that key again. In that case numeric lock is preferred but it will be tedious task to remember the password of that numeric lock.

The solution to said problems is to use fingerprint for unlocking purpose. Biometric data are separate and distinct from personal information. Biometric is the measurement and statistical analysis of people's unique physical and behavioral characteristics. The technology is mainly used for identification and access control, or for identifying individuals who are under surveillance. For providing more security the lock is provided with the wired shackle. That is if someone tries to misbehave with lock then a message send to the user's phone number. Also an alarm will activate. In this way we will provide security plus convenience while using the lock in day-to-day life.

1.1 Objectives

- To make use of fingerprint sensor instead of typical key for conventional padlocks for getting more high speed and accuracy, so that only an authorized person can deal with specific padlock.
- To give more security by providing additional security at shackle of lock and with the help of software programs.
- To deal with Arduino for reducing extra interfacing that means to reduce complications.
- To provide one charging slot to the padlock itself so that in the case of emergency user can charge her/his mobile phones.

1.2 System Specifications:

1.2.1 Input Specifications: Input DC Supply: Lithium ion battery 5V, 500 mA.

Number of Users: 5.

Authentication: Biometric: Scan finger of the users.

One time password: 4digits OTP, if 5 unsuccessful   attempts of fingerprint sensed.

Security: Detect unauthorized person who tries to cut lock using vibrations & wire.

1.2.2 Output Specifications:

Locking/ unlocking mechanism:

Locking period: 1 to 2 sec. (approximately)

Unlocking period: 0.8 sec.

Audio Indication: Alert signal if un-authentication occurs.

SMS: Send massage to user within 2 to 3 sec. about un-authentication and OTP.

II. Literature review

From ancient time we are using different types of security systems to protect our valuable things. Extensive literature survey have been carried out for this proposed work. The following 7 papers are referred:

In[1], Joseph Bramah, designed first lock for Bramah's around 1784 which was awarded patent in 1787. That was a simple metallic lock attached to door itself. It has a single key used for locking or unlocking purpose.

In[2],Omidiora E.O. et. al., introduced finger print based lock for bike which is the robust security mechanism in 2011. They uses software module to store database of valid user. Programming was done with the help of Visual Basics, Visual C and Visual C++. They have stored 20 images for testing and the microcontroller was clearly differentiated between authorized and unauthorized users.

In[3],Ms. ReetuAwasthiet. al.(2013), focused on the crime, fraud and threats being central & all occupying, Security is indispensable. "The secret agent places his palm on the grid panel as a thin red scans his entire hand from left to right. "Biometrics is a technology that has been glorified in movies, and comic books as a thing of science fiction and "James Bond" styled security access systems. The response time of this system is less.

In[4],Raghu Ram.Gangiet. al., thought to provide 4 step for identification around 2013. First RFID reader reads the ID number from passive tag and sends to the microcontroller, if the id number is valid then only it open the fingerprint scanner and if the fingerprint is matched then microcontroller sends the password to the authenticated person mobile number then the authenticated person enters the both passwords in the keyboard which was already given by the user and received from the microcontroller. If these two passwords are matched then the locker will be opened otherwise the microcontroller sends the warning message to the authenticated person mobile number and it will be remain in locked position.

In[5],Pavithra .b.cet. al. (2014), used R303A for scanning because it has in-built ROM, DSP and ROM. This fingerprint sensor is capable of storing 100 finger print. It operates in two modes in master mode is used to store the finger print in ROM with unique ID. They have also provided a numeric lock. This lock consists of a LCD screen, keyboard and a microcontroller 8051.

In[6],Aditya Shankar et.al.*,* focused on the replacement of conventional techniques of locking system in 2015. The old methods like lock & key system and password authentication system was replaced by the biometric system. They basically used fingerprints for the authentication system. The person whose fingerprint saved in the database can easily access the locker. They interfaced fingerprint sensor with 8051 microcontroller. But the system had no provision to alert in case of misbehaviour with locker.

In[7],CrystalynneD.Cortezet.al., added a short message service with biometric lock in 2016. The microcontroller ATMEGA 644 Arduino board was used to interface the input and output hardware devices and it uses 9-12V_{DC}. They have used finger print sensor to recognize user, numeric keypad for password and displayed time and date using real time clock.

III. Methodology
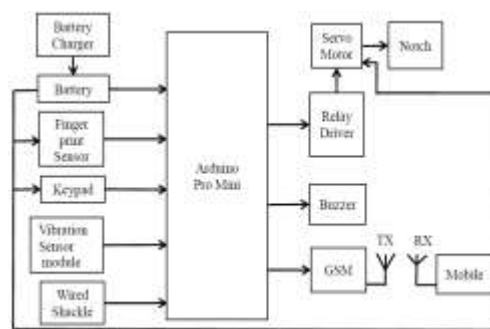
3.1. System Overview

Fig. 1 Workflow of proposed work

The system will take input from fingerprint of users with the help of fingerprint sensor. Currently this method is designed for five users but it can be extended up to 157 users based on the memory capacity of sensor. Then the arduino pro mini will compare it with stored database, if it matches then arduino pro mini will unlock the shackle by driving the servo motor.But in case it does not match with stored database, user can try to give his/her fingerprint for 5 times and if it fails then the system will identify the person as unauthorized user and keypad will activate then the one time password will be sent to registered mobile number using GSM.

The name Antitheft suggests that if any thief tries to cut the lock he will try to cut at the side of shackle so we are providing a wire at shackle and at that time wire will break and it will not provid e the signal to the input pin of arduino where the wire is connected. So the arduino will detect it as open switch and the Short Message Service (SMS) will sent to the user that someone is trying to cut the lock and at the same time buzzer will activate to alert the neighbours.

To make the system portable we are going to use Lithium Ion battery to give the supply to arduino, fingerprint sensor and keypad. The battery is small in size as well as portable. If the battery voltage falls below the threshold voltage then also user will receive an SMS that the battery charging is low and it needs to be charged.

3.2 Algorithms
3.2.1 Algorithm for fingerprint enrolment:
Arduino Integrated Development Environment (IDE) software is used for preparing the fingerprint database of the users, require steps as mentioned below:
- Start
- Include Ada fruite fingerprint sensor library.
- Open Arduino IDE
- Go to file
- Then go to example
- Select Ada fruite fingerprint enroll
- Save and Upload Sketch
- Open serial Monitor window
- Place the finger on sensor
- Then give an ID, for example:ID1
- Now remove finger
- Place same finger again

Check if database matches then enrollment will be successful.
The complete working of Antitheft biometric padlock system required the following steps:
Step1: Start
Step2: Read the signal from sensor and process
Step3: Check fingerprint is registered or not
Step4: If yes then turn on Servo motor to open the door
Step5: If not then scan fingerprint for 4 times again
Step6: If it is less than 5 go to step 2
Step7: After 5 unsuccessful attempts send an OTP registered mobile number.

IV. Conclusion

We have studied conventional security system for locking houses, offices etc. using traditional lock with its Key. Though they are secure, but there are disadvantages like remembering keys of each lock also problem of forgetting the keys as well as password etc. The proposed security system based on Biometric and GSM. This system provides correct and fast user verification using Biometric authentication. Moreover Fingerprint is unique Identification for everyone so it cannot be easily hacked.

Acknowledgements

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