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Smart Locker: IOT based Intelligent Locker with Password Protection and Face Detection Approach

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Abstract

In today's world, security becomes a very important issue. We are always concerned about the security of our valuables. In this paper, we propose an IOT based intelligent smart locker with OTP and face detection approach, which provides security, authenticity and user-friendly mechanism. This smart locker will be organized at banks, offices, homes and other places to ensure security. In order to use this locker firstly the user have to login. User has to send an unlock request code (OTP) and after getting a feedback Email with OTP, he/she will be able to unlock the locker to access his/her valuables. We also introduce face detection approach to our proposed smart locker to ensure security and authenticity.

1. Introduction

Over the decade, everyone is concerned about the safety of their valuables like jewelry, money, important documents etc. For ensuring the safety of these valuables bank can be an effective solution. However, due to the increasing rate of criminal approach it becomes difficult to ensure security of the valuables. Banks are considered as a soft target of criminals. In this circumstance, ensuring security of bank lockers should be taken into consideration. Therefore, in a paper we propose a smart locker, which is mainly, an IOT based intelligent locker. We also introd uce password and face detection approach.

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In this work, we consider one-time password (OTP). OTP is a dynamic password, which is valid only for one login session. OTP overcomes a number of shortcomings of traditional or static password based authentication. As we propose a smart locker for ensuring security, ensuring authorized access and overcoming all the misuses. This system can be applicable in banking sector or for any personal purpose. For this reason, we use OTP to overcome unauthorized access. In our system, a registered user can send request for OTP to unlock the desire locker. Then the password is send to the user through mail. The session of OTP is set for 20 minutes. OTP has a major advantage in contrast to static password is that they are not vulnerable to replay attacks. As OTP has a predefined session of validity, so it becomes difficult to abuse it by hackers or any kind of intruder. Another important advantage of OTP is that it does not make vulnerable on all of them, a person who use the same password for multiple system.
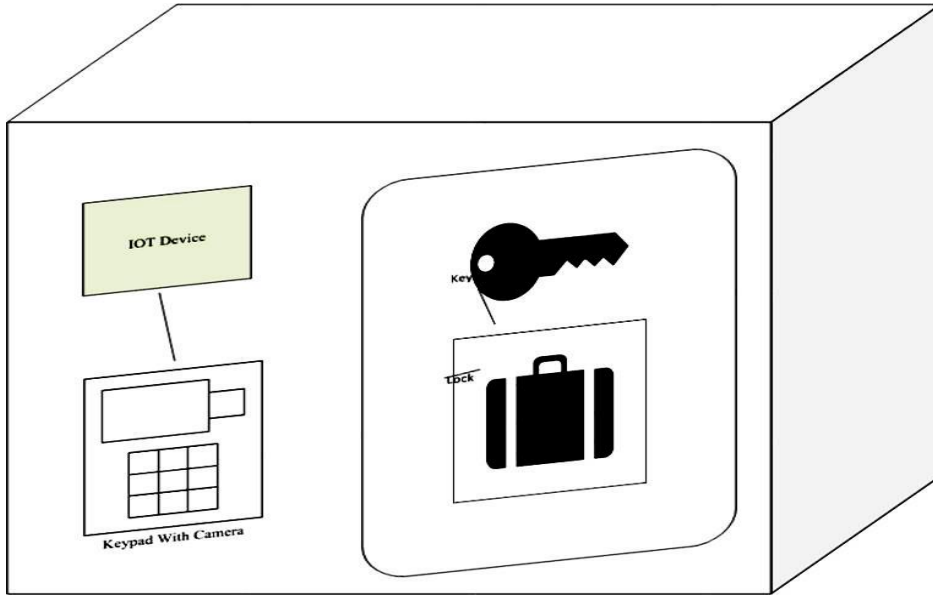

Fig.1. A view of IOT locker system.

Face detection approach is also introduced to ensure security and authenticity. Face places a vital role in social intercourse for conveying identity. Face detection determines the location and size of human face in a digital image. In this paper, we propose a smart locker, which is mainly IOT, based intelligent locker with password protection and face detection approach. The main objective of this system is to ensure the security of valuables. A view of IOT based locker system is showed in Fig.1. and proposed system's block diagram has presented in Fig.2.

2. Related Work

Many researchers have implemented a smart locker system. Many of them have proposed a lot of idea to implement a smart bank /house locker system. A multilevel security system for bank locker [1] is proposed by Aishwarya Shah et.al to improves the security. This multilevel security system is mainly based on Fingerprint scanner, user password, RFID, temperature and IR sensor, Android application [11]. An intellectual bank locker security system [2] is designed by S.V. Tejesviet.al which is mainly based on fingerprint [8] and GSM technology [9,10]. According to this system user's name, finger print and mobile number is registered. The system will identify the authorized person by matching the finger print with the pre-registered fingerprint and

by the code that will send to the mobile of the user with the help of GSM technology. Otherwise, the system will blow an alarm to ensure security. In order to design this security system, they also use microcontroller, PIR sensor and vibration sensor. Another bank locker security system [3], which mainly based on RFID [12, 13] and GSM technology. The main advantage of this security system is that two different password is required for verifying authenticate user. This system firstly checks the validity of user id number, then it sends SMS (Short Message Service) request to the authenticated person mobile number for the original password to open the locker. Then microcontroller verifies the password with the password entered by the keyboard. If these two passwords are matched then the locker will be opened, otherwise the locker will be remained locked. A system [4] is used to control home appliances especially when the owner is away from home. Another smart home security system is proposed [5]. This system allows the owner to monitor and control the home appliances by using a mobile phone by sending SMS and also allow checking the status of the home appliances. To ensure security of valuable an IOT based security system is proposed in [6]. In this system authenticate person is verified by using OTP, face recognition techniques and PIN (personal identification number). In this system, OTP will be sent to user via SMS and email notification will be to the users. In this system, GSM (Global system for mobile communication) will help the owner to track the intruder with the help of police officials. A framework that will produce OTP (one-time password) is proposed in [7]. Bio metric finger print and iris scanner based locker system [14] has been proposed by Amit Varma. In this system he proposed a multilevel bank locker system. Bio metric based another Authenticated [15] bank locker for security system has been proposed by S. Sridharan. He proposed this system by dividing into two part. One of them is branch head biometric and custom biometric. All this system will give an Authenticated secured locker system. Neeraj Khera et.al implement a security system for bank locker by using the algorithm of motion detection [16] of unauthorized person. They have used the local area network for saving the image of motion to the web server and also have an option to send a warning message to the operator using GSM technology. Raj Gusain et al. proposed a system of bank locker using face recognition, Iris scanner and PVR [17] technology. Matlab software based image processing, Iris scanner and vascular pattern thinning algorithm based PVR are used to implement this bank security system.
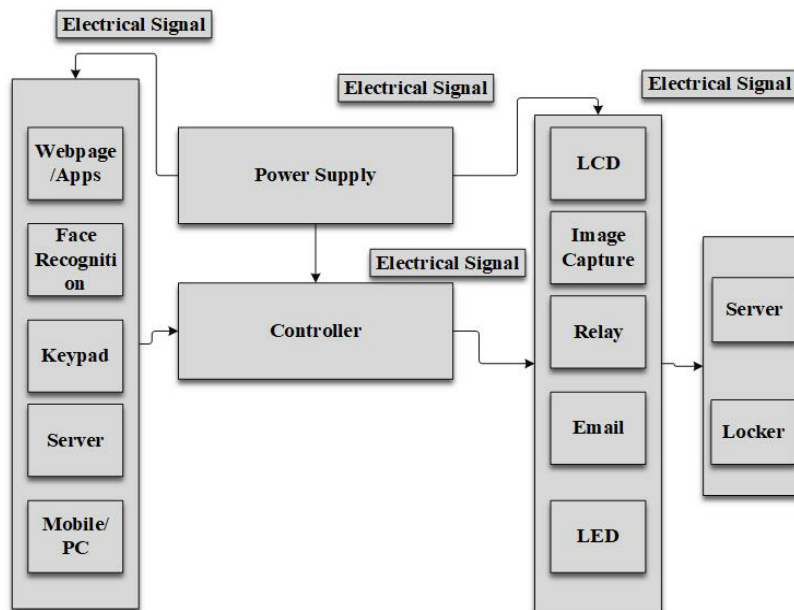

Fig.2. Block Diagram of proposed system.

3. Motivation and Methodology of Proposed System

This research is mainly based on IOT. Many researcher have developed, implement or proposed differeny system to ensure the security of bank locker.as security has become a prime need,this concern motivated us to proposed such system.so in order to ensure security of individuals we can use this system. The whole system is designed to implement through internet server. Here the random number of 6 digits is generated by PhP random number generate function and user has different option to send a request to server to unlock the locker. An API (**Application-Programming Interface**) is designed to access the database to match the valid OTP with given OTP through keypad. Another method is used in this proposed system is that only single person have to present to unlock the key.

4. Working Process of Proposed System

In this paper, we proposed a smart locker, which is mainly based on IOT. We mainly introduce a smart locker with password protection and face detection approach. In this system firstly a user has to login with the help of a web browser. If the user does not have any login information, then he has to go through the registration process. After login a user will able to check the list of lockers. If the locker is not available, then he will also able to add lockers. In order to unlock the locker, he will have to send an unlock request code to server. In our system the code validation time is 20 minutes. The code will send to user via email service by server. Here the status of the validation code will also be checked. We also introduce a face detection approach. Here we have a face detector to detect the face of the user. The image of the registered user will be stored in the server through the registration process of the user. If the face exists, then an unlock request of the locker will send. Then the system will count the number of faces. If the count is 1 then the system will go to the next step. The user will enter the unlock code. Server will verify the code. If the code that is send to the user and the code that is stored in the server is matched, then the locker will be unlocked. If any mismatch is happened, then the system will capture an image of the intruder and send it to the server. The face count approach will help to reduce the chance of any kind of inconvenience to occur by any unauthorized user. This approach will ensure the security and authenticity of the locker. Fig.3. shows the flow diagram of the proposed system.

We have another feature of the proposed smart locker and that is, the system is able to measure the temperature of the locker. If the temperature is greater than 40 then a mail will be sent to the user. It will help the user to take effective steps to ensure the security of the valuables. Flow chart of the Locker when intruder try to unlock by using Heat.

5. Components required for Implementing the Proposed System

This proposed Smart locker system has been implemented by using the combination of some hardware and software. In this proposed system Atmega328 microcontroller based Arduino Uno board has been used for decision-making purpose. For locking and unlocking function 4*4 keypad has been used. The main device used in this proposed system is Arduino Shield named as 1sheeld. With this shield, mailing information to the server, image capturing and sending to author, face detection function are obtained. 1Sheeld will be connected with android mobile phone through Bluetooth and an android application help to function this proposed idea. However, the mobiles connected with Internet to send data into the server. The keypad is used to send OTP to the server through microcontroller. Here, a LCD (Liquid Crystal Display) is used to identify the sent OTP on the mail and given OTP to the controller is correct.

The matrix 4*4 keypad functions according to matrix. This keypad has four columns and four rows. Every row is set to zero logic and every column is set to one. If one button is pressed, then the row will be connected to column and change the previous column's status into low. By scanning the column by sending one to rows, the exact column value can be identified.
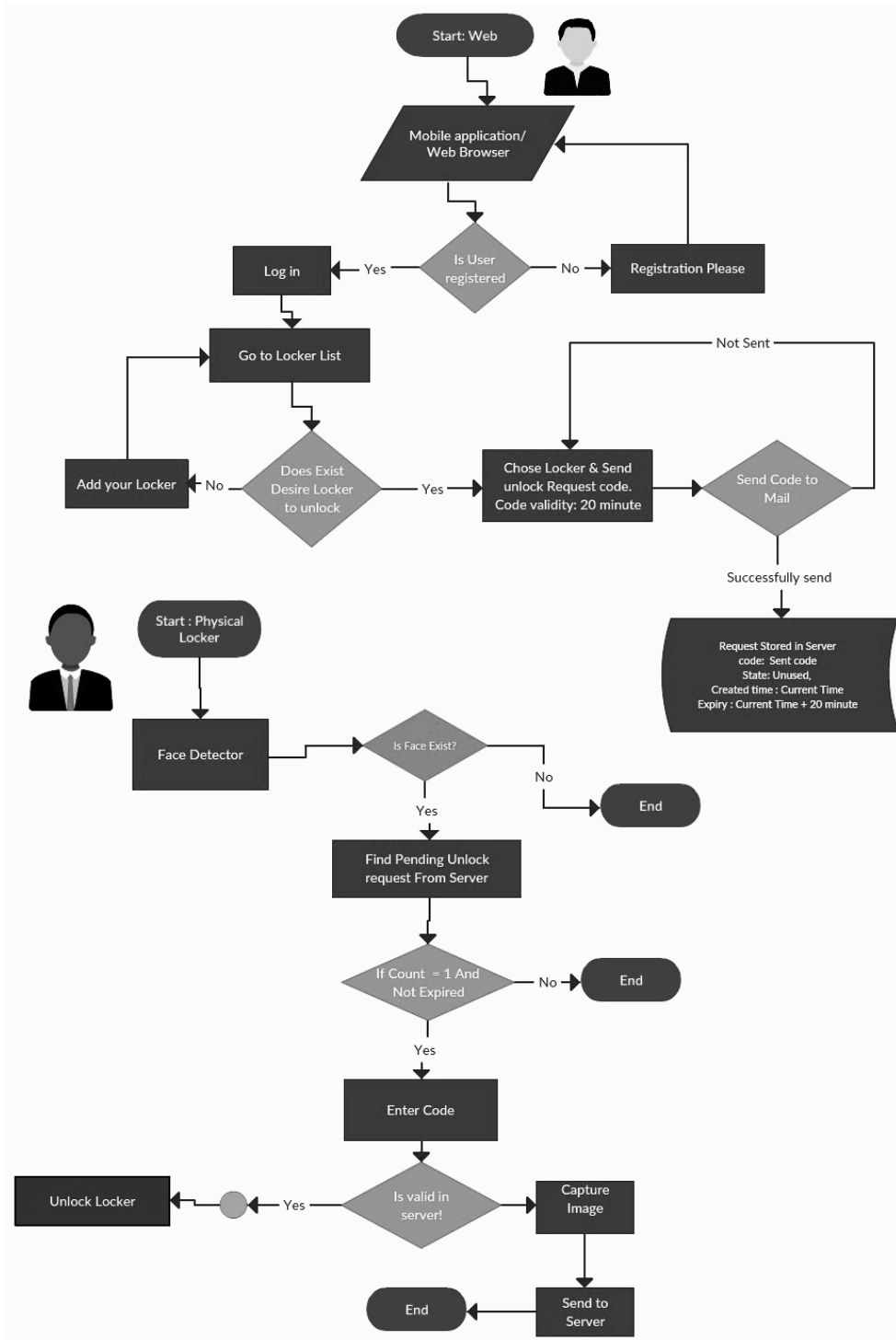
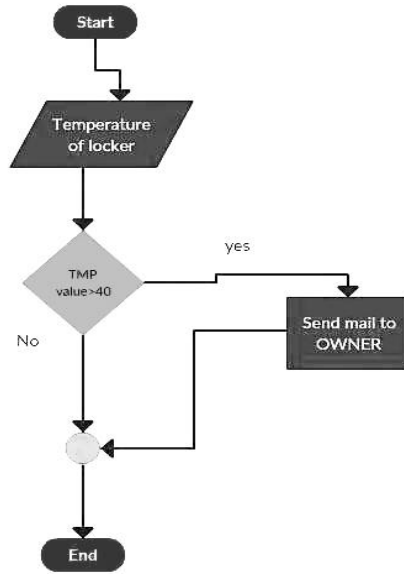Fig.3. Flow chart of the proposed system.

Fig.4. Flow chart of the Locker when intruder try to unlock by using Heat.

   The LCD display shows the character from its set cursor point. This LCD shows total 32 characters at a time. A four data lines help to show the character on the display. This LCD has 2 rows and 15 columns. Every row and column's intersection create a coordinate number that the cursor number to start the printing.
   1sheeld is package of arduino shield of 40 different shields. This shield and mobile application perform togather.to finish the operation.
   In this implemented system android phone camera has been used to identify the number of people present in front of the locker. Heat sensor is used to measure the heat of the locker to identify the unauthorized access to unlock the lock using heat generate.
   The android application to detect face has been focused. When this application detects face then it identifies every face into its individual id. When multiple faces has been detected then this application creates different color of frame for different user and give individual id for every face.
   The processing device we have used in this system is Arduino Uno. Because 1Sheeld is a complete shield package comfortable with Arduino Uno.

Table 1. Component's response. in details

No of equipment's	Name of the equipment's	Variable	Reference value
1	Keypad (stating value)	Generated OTP	CHAR, ARRAY
2	1sheeld		DATA
3	Heat Sensor	Temp Value	Analog value (0-1023)
4	Arduino Uno	Controller	Digital(0,1)/ Analog (0-1023)
5	Android application		DATA
6	Keypad (User operation)	Submitted OTP	CHAR, ARRAY
7	Android Phone Camera		DATA
8	LCD(Liquid Crystal Display)		CHAR

6. Result and Discussion

The implemented system of Smart locker functions nearly accurate to the proposed system. Different condition has been tasted that are showed in Table 1. Face detection function has been tested that works accurately to generate or not generate OTP. Heat sensor function nearly accurate and response 90% accurately to function the proposed work.

Table 2. Testing the accuracy and reliability of the system.

No of observation	Name of the equipment's	Condition Value	No of Experiment	Performance/Result
1	Face Detection	Number of detected face more then 1	4	OTP does not generate
2		Number of detected face equal to 1	5	OTP generates
3	Heat Sensor	More than 40 degree	7	Run the buzzer and Send Capture image to server
4		Less than 40 degree	7	Does not Run the buzzer and Send Capture image to server
5	OTP	Generate Time>20	4	Invalid OTP
6		Generate Time <20	5	Valid OTP

Fig.5. shows the detected face and this system goes to next functioning when number of face will be one. If detected face will be more than 1 this system will not execute to the next step.
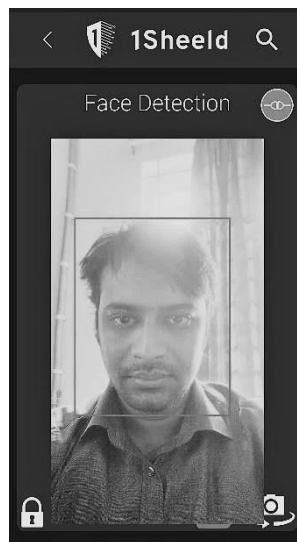

Fig.5. Detected face by using 1sheeld android application

Fig. 6. shows the image to send the OTP code to the user for a fixed valid time. This code is invalid after 20 minutes. User has to send another request to the server.
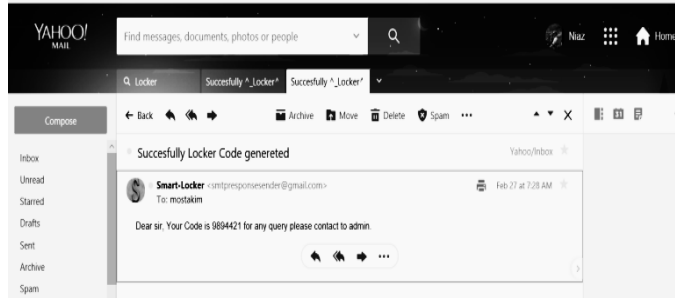

Fig.6. OTP generate and send to the user as mail.

Fig.7. Two faces identification

7. Conclusions

In this paper, we have proposed an IOT based smart locker to ensure the security of valuables. It ensures security by provided OTP. In this system, firstly, a user has to send request to the server for an OTP and server will provide this OTP by sending a feedback Email to user. This system has also face detection approach that will count the number of user's presents in front of the locker at any particular time. If the system detects more than one face at same time, then a notification will send to the user. This smart locker is much better than traditional locker because it does not require any traditional key to unlock the locker. It is highly reliable system to ensure the security of our valuables.

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