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Research paper

Implementation of Embedded based Bank Security System using Knock-out Gas

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Abstract

The number of banks and the number of theft increases rapidly in the recent years. Most of the customers are using bank operations for savings account, keeping valuable jewels in the bank locker and availing loan for purchase of home. Bank manager is responsible for customer's documents such as varieties of deposits, jewels kept in locker etc. The conventional bank security system is not effective and theft of cash, jewels etc. happen easily. The police cannot find the robbers easily. This proposed bank security system is novel, highly secure and cost effective embedded system which ensures bank security by releasing knock-out gas. It is operated only during the closing hours of banks. When any robber tries to enter the bank, the sensor kept near the locker senses and sends the signal to the microcontroller. The microcontroller sends the signal to the relay circuit which activates the gas releasing equipment to release the knock-out gas for a specified period of time. The release of knock-out gas towards robber makes him fall down. The signal from the microcontroller also sends to the Bank higher official's mobile through the GSM. The Bank security personnel can easily catch the robbers with the help of police. This proposed bank security system is fully automated system which ensures safety to highly valuable customer's documents, cash, and expensive ornaments present in the bank locker.

Keywords: *Arduino; GSM; Knock-Out Gas; Relay; Security.*

1. Introduction

Security has become an essential issue for banks. Security is the protection of something valuable to ensure that it is not stolen, lost, or altered. Every person having cash and jewels need to keep in safe place. Bank allows customers to keep their jewels in locker and deposits the cash. The number of bank customers is rapidly increasing and the bank need to ensure the safety and security for the customer's assets. The manual security system is not effective and theft may happen easily because of security is not alert especially during night time. The CCTV (Closed Circuit Television) camera may be broken by the robbers and theft of valuable jewels and cash is possible. The CCTV cameras are inefficient due to significant amount of memory utilization and it is expensive. These cameras also record even there is absolutely nothing happening in front of them. The alarm based security system may alerts the robbers and it allows escaping the robbers easily.

Currently, there is frequent theft happening in all public as well as private banks. The conventional bank security system is not enough to secure the customer's assets and bank properties. Bank is a place where lot of money transactions takes place and storage of highly valuable ornaments by the customers. The security system for banking sector should not only protect the assets but also ensures customer's privacy. The personal information such as account number, ATM number, jewel locker number etc. should not be accessed by the unauthorized parties. In addition, security is most important in internet banking operations because majority of customers availing the internet banking facilities for money transactions.

Bank locker security is another important concern in the security system. The existing bank locker system is manual lock. The customer can operate his/her locker only with the help of bank employee and it is waste of time for both the customer and the employee.

The bank locker security system proposed [1] which adopted MEMS (Micro-Electro Mechanical System) technology along with RFID (Radio Frequency Identification) and microcontroller devices. MEMS accelerometer is used to sense the motion in three dimensional axes. A predetermined password can be set by the user for a fixed set of motions. The microcontroller senses the motion and asking for a password if motion is detected. The system will be blocked if the wrong password is entered. The drawback of using MEMS is that the sensors used are not cost effective and it is complex to use in real-time applications.

The bank security system was implemented with the help of RFID and GSM technology [2]. RFID technology is used for identifying the objects and GSM (Global System for Mobile Communications) is for sending the message to the authorities. It allows access only to the authorized users of the bank lockers. The drawback is that the user needs to remember the password to open the locker.

The bank security system is based on Internet of Things (IoT) for secure accessing of bank lockers only by authorized person [3]. When any person tries to access the bank locker, Raspberry Pi captures the image, processes it and sends it to the user's whatsapp account as picture message. The authorization should be provided by the user to the Raspberry Pi from his whatsapp account number to open or shut the locker.

The bank locker security system which is raspberry Pi based face recognition technique in order to identify the authorized person entering the locker room [4]. RFID and GSM technology together used for secure access of the locker. When the person tries to access the locker, the access code is sent to the user mobile. The

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access code is sent only to the authorized person and the unauthorized person cannot access the locker. The sensor detects the entry of unauthorized person and sends the control signal to raspberry Pi which generates audio alarm. The drawback is alarm signal alerts the robber and he escape easily.

Automatic locker system can overcome the drawbacks of manual security system. RFID tags can be used which holds the customer's details such as username, locker number etc. The RFID method is used to identify the person using radio frequency transmission for securing bank lockers [5]. It is an automatic identification technology where digital data encoded in an RFID tag is read by the RFID reader. An RFID system consists of a reader device and a tag. RFID uses the radio waves to capture the data from the tags which is similar to bar code technology.

The bank locker security system proposed which uses web camera to capture the image of the robber [6]. The Wi-Fi module which is inbuilt in the raspberry Pi uploads the captured image to the web server. The raspberry Pi will generate the One Time Password (OTP) and send it to the authorized mobile number. The user needs to enter the OTP in order to open the locker. The locker cannot be open if the OTP entered is incorrect. The drawback is the CCTV camera is expensive because it requires computer to monitor the image.

The security attacks and vulnerabilities in online banking system are addressed [7]. The major online banking attacks are obtaining authentication and identification information. The end users of online banking require secure entry of login and password as well as secure money transactions. It is most important to secure the data during transmission over a network.

The bank locker security system proposed which is based on face recognition and GSM technology [8]. Face Recognition is done by using active appearance model algorithm with Bayesian classifier, which is used to identify the persons and verify their identity with the Raspberry Pi processor.

The proposed bank security system is based on four digit random number received by the user as a password during the access of locker [9]. When the user enters the password, the locker can be open. If the password entered is wrong, the locker cannot open. The unauthorized parties cannot access the locker.

The problems in online banking and its need for security testing are addressed [10]. The system allows the user to perform secure transactions from anywhere and anytime. The SMS messages are encrypted using symmetric key IDEA (International Data Encryption Algorithm). The customer can perform secure transaction in the online banking. The challenges in privacy and security as well as countermeasures against security attacks in banking sector [11]. The cyber security attacks are analyzed on data security and privacy in banking sector. The countermeasures include anti-key logger which scans the banking and client information. It also protects the credit card number from unauthorized access.

The various technologies are adopted for secure banking operations. But, still the frequent theft is happening and the police find difficulty in catching the robber. This proposed bank security system is cost-effective and makes the robbers fall down by knock-out gas when they come near the bank locker and cash storage place.

2. Block diagram and description

The proposed bank security system releases the knock-out gas towards robber with the help of PIR (Passive Infra-Red) sensor, Arduino, relay and gas releasing equipment.The fig. 1 shows the block diagram of bank security system by releasing knock-out gas and it sends the information about unauthorized person entry to the bank manager's mobile through GSM.

Any robber tries to enter the bank, PIR sensor detects the entry of robber into the bank and sends this detected signal to the Arduino board. The Arduino is programmed to read the sensor data and send it to the gas releasing equipment through relay. The signal from the Arduino is also sent to bank manager through GSM.

GSM is a second generation digital mobile telephone standard which is based on combination of Time Division Multiple Access (TDMA) and Frequency Division Multiple Access (FDMA) to share the bandwidth among as many subscribers. GSM supports multiple frequency levels such as 900 MHz, 1800 MHz and 1900 MHz.

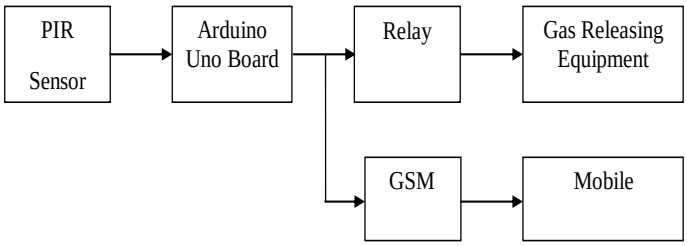

Fig. 1: Block Diagram of Bank Security System by Releasing Knock-Out Gas

The gas releasing equipment is AC powered in which knock-out gas such as methyl propyl ether or methoxyflurane is filled. This gas releasing equipment is kept near the locker. The Arduino is programmed to activate the relay circuit which inturn connected to the gas releasing equipment to release the knock-out gas. When the robber tries to enter the locker room, the knock-out gas starts releasing towards robber. The released knock-out gas reduces the conscious level of the robber and makes him fall down for few hours.

When the bank manager receives the continuous ringing from his mobile and alert message, he informs the police. The police will come immediately to the bank location and catch the robber easily. The proposed bank security system allows to safe the valuable ornaments, cash and documents.

3. Flow chart

The fig. 2 shows the flowchart of the proposed bank security system. It indicates the sequence of operations involved in catching the robbers and securing the customer assets.

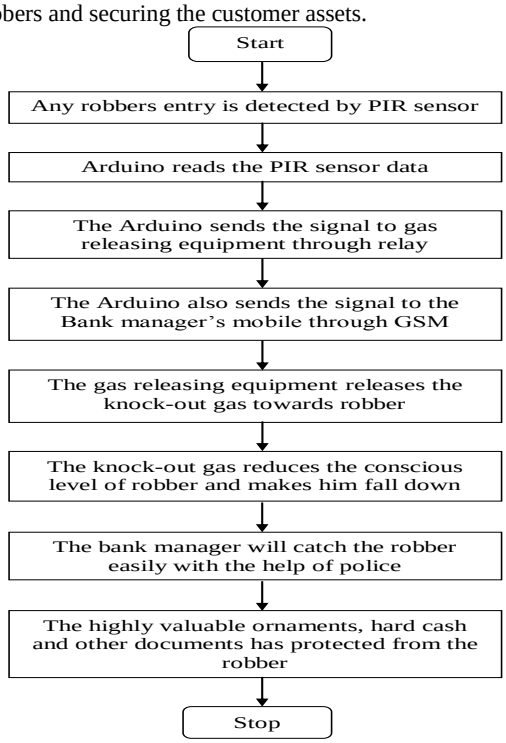

Fig. 2: Flowchart of the Proposed Bank Security System

4. Implementation of proposed bank security system

The figure 3 shows the implementation of embedded based bank security system by releasing knock-out gas. The three pins of PIR sensor are power supply, output and ground which are connected to the Arduino Uno board. The Arduino Uno board is connected to the relay board which inturn connected to gas releasing equipment. If any robber tries to enter the bank, the PIR sensor detects and sends the signal to the microcontroller. The Arduino code reads the PIR sensor data and makes the relay circuit ON. This relay circuit sends the signal to the gas releasing equipment which starts releasing the knock-out gas. The release of knock-out gas reduces the conscious level of the robber and makes him fall down. The Arduino also sent the signal to Bank higher officials mobile through GSM. Once the Bank manager receives the signal in his/her mobile, he/she can easily catch the robber with the help of police.

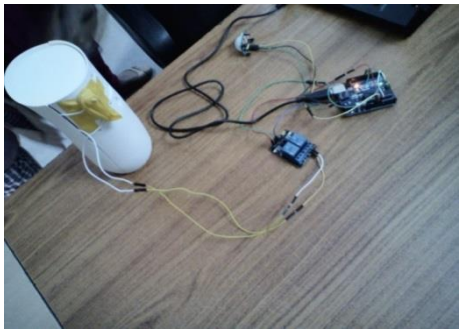

Fig. 3: Experimental Setup of Embedded Based Bank Security System by Releasing Knock-Out Gas

5. Comparison of proposed bank security system with existing bank security system

The following comparison table shows that bank proposed bank security system allows catching the robber easily and it is cost effective as compared to conventional CCTV camera security, Alarm based security, RFID and MEMS technology.
The proposed bank security system is a novel and innovative because it uses knock-out gas to catch the robber which is not currently exist as well as not implemented in any banking sectors. The proposed security system is also applicable to the jeweler shop, accounts department in the institutions, public and private sector, home security etc. It provides cost-effective solution because it uses embedded system. It protects the bank assets includes documents, cash and ornaments from robbers. It also allows police to identify and catch the robbers easily. This proposed work should be implemented in all cash handling sections to ensure secure and safe operations.

Table 1: Comparison of Proposed Bank Security System with Existing Bank Security System

Method	Developed by	Approach
GSM Based Bank Locker Security System using RFID Password and Fingerprint Technology	Hiloni Detroja , Prutha Vasoya , Disha Kotadiya , Bambhroliya [5]	RFID method identifies the person using radio frequency transmission for securing bank lockers
Camera Based Monitoring and Security System	Jhansi Rani, Ramya [6]	Web camera and raspberry Pi is used to capture and uploads the image of the robber
Banking Security System Using MEMS and RFID Technology	Abhijeet Kale, AniketDeshmukh, MangeshBenodkar, Prasad Nage, SuyogFukate [1]	MEMS accelerometer is used to sense the motion and the microcontroller asking for a password if motion is detected
Raspberry Pi based Face re cognition technique	Elaveni, Balasundari [4]	Raspberry Pi generates audio alarm when the robber tries to enter the bank
Proposed method: Bank Security System using knockout gas	Prasath, Natesan, Jeyakkannan	Arduino is programmed to monitor the entry of robber and send the signal to release the knock - out gas towards robber

6. Conclusion

The security is top most priority in the bank operations. It is essential to secure the ornaments, cash and documents from the robber. The proposed bank security system ensures security to customer's assets. When any robber tries to enter the bank, the security system allows catching the robber easily by releasing knock-out gas. This knock-out gas reduces the conscious level of the robber and makes him fall down. The information about entry of robber also sent to the bank manager's mobile through GSM. The bank manager will catch the robber and handover to the police. The proposed bank security system not only catches the robber but also protects the highly valuable customer's ornaments, hard cash and other important bank documents from the robber. The future work is to implement this proposed bank security system in all the banking sectors.

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