Smart Card for Healthcare and Transit Systems

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***Abstract*—Smart cards have been in use since some decades now. In this smart card system, there is an integration of both healthcare and transit systems, smart card that is scanned using RFID, is credited with the fare of the journey from the bank account of the user directly in case of the transit mode instead of the conventional crediting using tangible currency, and in the healthcare mode user's health related information are stored dynamically by measuring parameters on the spot using spirometric sensor and heartbeat sensor. Hence a more reliable system is implemented.**

Keywords: RFID, Spirometry, Dynamic data storage.

I. INTRODUCTION

The need for security in storage and transactions is increasing day by day. So it is necessary to provide security oriented transactions for the welfare of the people. Smart card is one of the oldest information processing devices that provide high security. For this reason it is one of the most widely deployed devices all over the world and is also present in our everyday life. A smart card is a pocket-sized and a portable card which is made up of plastic used for data storage and application processing. Smart card can also be used as an electronic payment device. As an electronic payment device, smart card offers various advantages, such as shorter transaction time, greater convenience for consumers, lower cash handling cost and fewer transaction errors. A typical smart card system consists of a smart card, card reader and a backend system. The card connects to the card reader by a physical contact i.e. a "swipe" or a "scan". And the card reader connects to the backend system which stores and processes the information of the whole system.

Like other devices, smart cards do have some striking features. Smart cards consist of RAM, ROM, and PROM etc. It has up to 8 kilobytes of RAM, 346 kilobytes of ROM, 256 kilobytes of PROM and a 16 bit microprocessor. The card uses a simple interface and receives the power from the card reader. The 16-bit microprocessor is used for the security purpose and also to store and transacts data. This data can be a value or a information or both that can be stored and processed within a card .Smart card readers are also known as card acceptance device (CAD), card programmers or as an interface device because card programmers can write to a card. When the smart card and the card reader come in contact i.e. when the card is swiped or scanned in the card reader, the information is exchanged between the card and the card reader. Smart cards are always reset when they are scanned using RFID. Like all other cards, smart card also does not allow the unauthorized users to use the card. Thus it provides some security measures to avoid unauthorized users from accessing the card.

Smart card provides many advantages. The most important advantage is its flexibility. Many applications can be integrated into a single card. So it reduces the number of cards for various purposes. One card can be simultaneously used for storing a person‟s personal information like telephone numbers or his/her medical history, and can be used as a transport card, etc. Incase if the card gets lost it can be easily replaced because like all other cards, this will also be provided with a PIN (Personal Identification Number). The next advantage is its security. Various encryption algorithms may be used to provide security. Other general advantages of a smart card are its portability i.e. it can be easily carried from one place to another. Next is its data storage capacity. As the system integrates two fields onto a single smart card, more space is needed. The data storage capacity of a smart card is increasing as the level of application increases. Next advantage is its reliability which means it is virtually unaffected by electric and magnetic fields.

Some features of smart card:

1. *Security*: Security is provided by using various encryption algorithms. And the information which is stored on the card can be accessed only by using a PIN.
2. *Intelligence*: The smart card is not only used for storing data but for processing data also. Communication with the devices can be done through a smart card reader. Also the information and applications can be updated easily without using a new card.

3. *Convenience*: Smart card provides a portable and easy to use platform in such a way that most of the people are familiar in using the card.

In the pressure sensor a nozzle is provided through which air is blown. Based on force of the air the lung capacity of the user is observed using which the blood pressure of the user is computed. In the case of heart beat sensor using the blood flow in the veins, which is in the form of sine waves – peaks (5V) and crests (0V) the corresponding voltages are observed and based on this the heart beat is measured.

II.EXISTING SYSTEM

A. Service in Transportation

Smart cards are used to collect fare of public transport. Once the customer swipe the smart card in a card reader the system automatically and continuously collect record of fare payment and the source and destination place. These records are used to observe volume of passengers at the point of ticket gate and the travel pattern are analyzed. Initially some amount is recharged and stored in the smart card. The cost of the travel is detected from amount which is initially stored. The main drawback is that the user comes to know the balance amount in the card only at the time of swiping the card in the card reader. There is no prior intimation about low balance in the card. There is no proper authentication provided, that is anyone who as the card and swipe and travel anywhere.

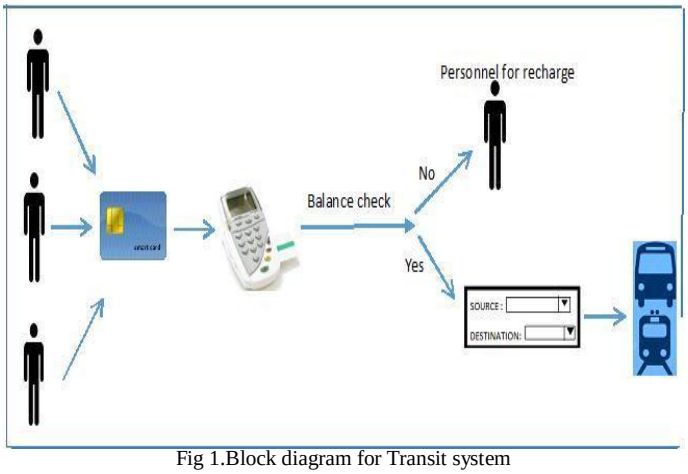

Fig 1.Block diagram for Transit system

B. Service in Health Care

Smart card in health care system collects, stores all the health related information about a person in a paperless system which is used in hospitals and or health service provider. The cards hold details of the patient like his name, ID, critical health factors etc. After every checkup the details on the card are updated. But the main drawback is that there is no proper validation of user information because the stored data may not be up to date always.

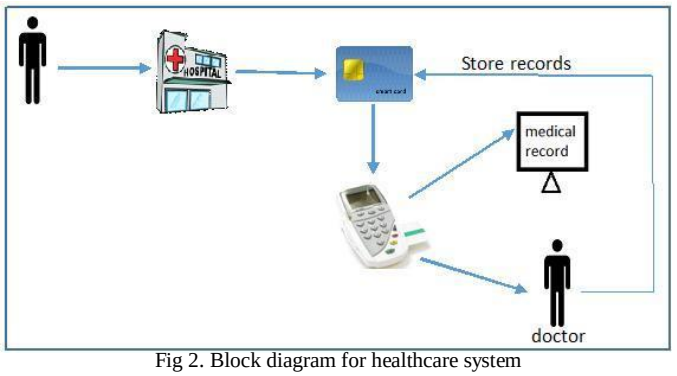

Fig 2. Block diagram for healthcare system

III.PROPOSED SYSTEM

In the systems discussed previously, there is not one platform where both the healthcare and transit details are integrated into one smart card. Both modules have their own disadvantages. For instance, in the healthcare systems there is no efficient way to keep the patient's critical health factors up to date unless the patient visits the clinic regularly; stale records become unusable during emergency. Also, one needs to carry bulky health records each time they visit a clinic in the absence of this smart card system. In the transit system, none of the proposed smart cards that are used make use of any security measure to protect the transaction. Also when one runs out of money he is unable to travel because current smart cards are credited using tangible currency. The proposed system is introduced to eliminate the problems in ease of use and dynamism in data.

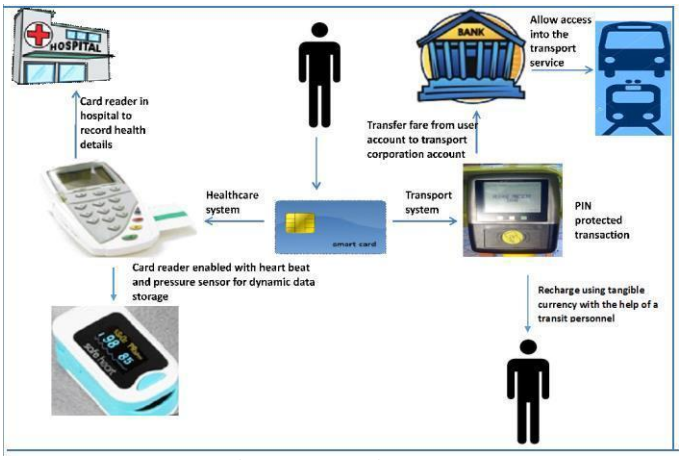

Fig 3. Proposed model of the smart card for healthcare and transit systems

The smart card for healthcare and transit system is shown in fig 3. When the user swipes the smart card in the card reader (Card Acceptance Device), the user is prompted with a Graphical User Interface displaying two options to choose from viz. 1.Healthcare System 2. Transit System. In the healthcare system the card reader is provided with a pair of sensors - pressure and heartbeat. By placing a finger on the sensor the pressure and pulse of the user are measured

A. Heart Beat Sensor

Heart rate is a very vital health parameter that is directly related to the soundness of the human cardiovascular system. This project describes a technique of measuring the heart rate through a fingertip using an AT89S52 controller. While the heart is beating, it is actually pumping blood throughout the body, and that makes the blood volume inside the finger artery to change too. This fluctuation of blood can be detected through an optical sensing mechanism placed around the fingertip. The signal can be amplified further for the microcontroller to count the rate of fluctuation, which is actually the heart rate. The sensor unit consists of an infrared light-emitting-diode (IR LED) and a photo diode, placed side by side, and the fingertip is placed over the sensor assembly, as shown below. The IR LED transmits an infrared light into the fingertip, a part of which is reflected back from the blood inside the finger arteries. The photo diode senses the portion of the light that is reflected back. The intensity of reflected light depends upon the blood volume inside the fingertip. So, every time the heart beats the amount of reflected infrared light changes, which can be detected by the photo diode. With a high gain amplifier, this little alteration in the amplitude of the reflected light can be converted into a pulse.

B. Spirometry sensor

A pressure sensor is used to measures pressure of gases or liquids. Pressure is defined as the force required to stop a fluid from expanding, and is usually expressed in terms of force per unit area. A pressure sensor acts as a transducer; it generates a signal as a function of the pressure imposed. In this project such a signal is electrical. Pressure sensors are used for control and monitoring in many of the everyday applications. Pressure sensors can also be used to indirectly measure parameters such as fluid/gas flow, speed, water level, and altitude. Pressure sensors can alternatively be called pressure transducers, pressure transmitters, pressure senders, pressure indicators and piezometers, manometers, among other names.

Once the sensing is complete the health data is stored in the card. This can be done very easily by the user himself without having to have an appointment with a doctor i.e. the update of the record can be done using the card reader cum sensor equipment placed at public places/exterior of clinics. This saves the user's time and efforts in visiting a clinic just in order to update the records. This also enables the records of the user to be refreshed constantly. Additionally, if the user has an appointment with a doctor, once his examination is done his prescription of medicines, tests and surgeries and other critical information like blood sugar, pulse, Cholesterol, hormone levels and blood pressure are stored in the card. This eliminates the cumbersome task of having to carry the medical records each time. This also facilitates the treatment and diagnosis of the user at any clinic and at any time. Apart from the health details, the card also stores the user's insurance information like the name of the insurance company, policy number, type and date of renewal/expiry. This avoids the complex processes involved in the submission of necessary insurance details every time the user gets treatment. Next, in the case of the transport system, when the user is prompted for a Personal Identity Number (PIN).

If the user does not punch the PIN properly he is given three tries utmost. If he fails in all of the four attempts, the card is locked. If the user succeeds in any of the attempts he is allowed to access the system. This makes the system more secure and less prone to anonymous usage. He can then choose the source and destination of the journey. Correspondingly, the amount of the fare is deducted from the registered bank account of the user. This makes it more convenient for the user when he runs out of cash at hand. This is very useful in times of emergencies and it also avoids burden of searching for the exact fare in the form of currency. As the fare amount is deducted, the same is credited at the account of the transport corporation. This aids in the easier computation of the received fare each day by the transport officials. This improves the accuracy and is more convenient. The major advantage in this is that the same card can be used for all types of transport for fare deduction, provided the card reader is installed.

IV.RELATED WORK

Smart cards are very versatile and portable devices which can be used for a variety of application. They also have a considerable amount of security.[9](smart card apps) They are very reliable telecommunication devices that are used to store data. .Smart cards are tiny computer-like devices that hold an inbuilt memory. Though the hardware and software capabilities of a smart card are less significant compared to desktop computers or laptops, they are very widely used for location-sensitive application.[8]. Smart cards have now become more identifiable with the help of RFID tags (Radio Frequency Identification) which enhances them [10].

One of the most important fields of usage of smart cards is the health care. When a smart card user comes and swipes the card his health related records are displayed. These health details are secured using keys. It uses the concept of public key cryptography like RSA, AES, and LSFD [4]. Smart cards are used in healthcare to have a portable system with data storage and easy processing. Smart cards in healthcare have an increased capacity and high performance. Cards can be used by both patients and doctors. Patient health detail and personal information are stored in the card [9]. User health details such as heartbeat and pressure is stored in the card. These details are stored dynamically into the card so that it can be used in emergency [10].

Smart cards are also used in the field of transit. On using this smart card in the transit system, it offers various advantages to the people. As the population is increasing in our day-to-day life, the demand for transport is also increasing. Evolution of smart cards in transit system has decreased the confusions in

tendering the exact ticket fare. In public transit, the smart card is said to be secured so that it can store all the transactions of the financial process. Once the card is made secure and is validated, the card contains some information about the card ID, ticket fare amount, route ID, bus ID etc. [11]. The smart card is not only used for paying the ticket fare, but also for determining the behavioral attributes of a trip by observing the continuous long term changes in the trips. The behavioral attributes in the smart card data is found out by two processes. One is by using the data fusion methodology, which means the process of integration of multiple data and knowledge representing the same real-world object into a consistent, accurate, and useful representation. And the other method is by using Bayes probabilistic model. [12].The existing system uses the above two processes to find out the attributes of the trips, but in the proposed system we can determine these attributes by using the manual method i.e. we can access the required attributes or data from the database which consists of the history of transactions as well as the information about the route which a person has preferred to travel. To avoid using the complex methods to find these attributes, in the proposed system, we have set a count variable in the transit database which tells us the number of times a person has chosen that particular route to travel. To mitigate the congestion caused by the ever increasing number of privately owned automobiles, public transit is highly promoted by transportation agencies worldwide. A better understanding of travel patterns and regularity at the „„magnitude"" level will enable transit authorities to evaluate the services they offer, adjust marketing strategies, retain loyal customers and improve overall transit performance. This travel pattern is identifying by using various data mining algorithms. [13].

V.IMPLEMENTATION

In our system the step down transformer is used to reduce the 230 V AC to 12 V AC or 5 V AC respectively. Both these voltages are stored at specified points. The circuit requires 12 V AC for the devices. Next 12V AC is input into a rectifier which converts AC to DC. The 1000 microfarad capacitor also called filter capacitor which uses electrolyte for capacitance, is used to block DC and allow only AC and removes any external noise. The voltage regulator that we user here is used to convert 12V AC to 5V AC, and it has 3 pins, first pin is 12 V input, second pin is ground, and third pin is 5 V output. Here, AT89S52 controller is used for storage and computation. The LCD is used to display any values that are recorded using the system. The ADC (Analog to Digital Convertor) 0808 is used for converting analog data to digital data. The Heart beat sensor uses pulse width modulation to convert the sine wave blood flow into beats it uses a single amplifier to produces the strengthened heart beat output in the form of an LED (Light Emitting Diode) glow and turn down. It also uses an IR (Infra-Red) diode to sense the blood movement in the vein at the finger. The pressure sensor records the flow of air from the lungs and models the analog input into digital pulse and records the blood pressure of the user. The EEPROM card is used to store the recorded values whose scanning is made possible using the RFID reader. Toggling provision for modes is also provided.

Fig 4: The RFID Reader

VI.CONCLUSION AND FUTURE WORK

There is a very large scope for future work in our system. In case of the healthcare system more dynamic health data recording devices like weighing machines, BMI calculator etc. can be added in addition to pulse and pressure sensors. Also the card can be connected to mobile phones of the user and his nearest family in order to remind them of any appointments at clinics and of any insurance related activities provided that the card is directly connected to the insurance agency. In the transport part the facility of recharging the card using currency with the help of automated machines enabled with currency sensors which helps the user when the bank account runs out of money may be provided. Also tracking the card in the journey to find its destination dynamically instead of picking the destination beforehand, can be done. The smart card system for healthcare and transport system can be used to improve the efficiency in the transport system by reducing the cumbersome efforts spent in rendering exact fares for transportation and improves security by using a Personal Identification Number (PIN) and also increases the integrity of data in healthcare systems by recording dynamic data

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