Raspberry pi based ATM Guard system

Treesa Tomy[1], Mr.Anoop M M[2]

[1]M.Tech Scholar, ECE Department, MGUCET, Kerala, India
[2]Assistant professor, ECE Department, MGUCET, Kerala, India

Abstract - The proposed ATM guard system is a real time monitoring system that traps robbers inside the ATM machine and detects the objects via a USB camera installed inside the room when a vibration occurs for a particular time. The embedded system used to develop this ATM guard system are Raspberry pi and Atmega32 microcontroller. The advantage of using this system is that it will eliminate the need of security guards in the ATM centers and providing more security to the centers from the attack of thefts. When vibration occurs for a particular limit, the system checks the presence of objects. Once it detects any objects then the system sends immediate message or makes call through GSM and there by automatic door lock happens.

Keywords: ATmega32 microcontroller, DC motor, Digital vibration sensor, GSM SIM900 module, Raspberry pi, USB camera

I. INTRODUCTION

Automated Teller Machine is a computerized telecommunication device that provides the clients of a financial institution with access to financial transactions. Now days, the number of ATM centers has raised adequately. Although it is storing money in the ATM machines, there is a great chance of theft activities. It could bring great losses of human and social wealth. Various types of ATM looting are occurred. ATM threat can be segmented into three types of attack: card and currency fraud, logical attacks and physical attacks. Here mainly focuses on the physical attacks. To prevent from these attacks various video surveillance based systems have been developed. The availability of several credit card sized single board computer such as Raspberry pi has enabled the creation of various automated and monitoring system that has low power consumption, faster processing ability at a lower cost. The ATM guard system proposed in this paper avoids the need of security officials in ATM centers.

A. Background study and overview

Different research and numerous prototypes of automated security surveillance system have been developed using various platforms. Recent improvements in GSM and microcontroller technologies have led to the developments of various anti-theft security systems. For example, Seyed

Nima Tayarani Bethari [1] proposed and implemented image- receiving system with the capacity of the face detection for using in the ATM. Separate face detection algorithm is used for face and eye detection, and results are connected together in the form of a novel cascade algorithm. Here motion detection is performed on the board. However, bank transactions in an ATM system only occur, when a correct face is detected. It is a advanced security system to the ATM transactions.

M.Ajaykumar et.al [2] designed a anti-theft ATM machine using vibration detection sensor. Here a vibration detection sensor gets activated when the attacker tries to damage the ATM machine and also a message is passed to the nearby police station. The AT89C51 microcontroller is used here. However, if a vibration occurred from other cases it will give false message to the corresponding officials.

Sivakumar T et.al [3] proposed a security based ATM theft monitoring system. This system uses ARM controller LPC2129 based embedded system to process real time data collected using the vibration sensor. Once vibration is sensed the beep sound will occur from the buzzer. DC motors is used for closing the door of the ATM. Camera is always in processing and sending video continues to the PC and message sends to the corresponding police station. It detects all vibrations and led to false information.

Ms. Umamaheswari et.al [4] proposed ARM7 based multilevel security for ATM acess using fingerprint and GSM technology. This system combines the pin verification and fingerprint recognition technology for identification. With pin verification and fingerprint technology she embedded the GSM module connected to the microcontroller. Biometric features cannot be replicated; this proposal would go a long way to solve the problem of account safety. This only features about the safety of individuals account transactions.

Rajesh V et.al [5] suggested iris recognition based biometric verification for ATM banking systems. Here, initially iris will be scanned after the verification of the identity of the person who is going to perform the transaction. The transaction is only possible when iris recognized is same as that from database .So first we need

iris details of each customers. Transaction can only limited with that particular customer.

Magnesh R et.al [6] also proposed a automated system for human face recognition in real time background. This introduces a principal component analysis to recognize the faces detected. The system proposed a real time design which takes image as an input through a webcamera continuously. Camera takes the image and it allows for the ATM transactions only if image matches up with the already stored image. It only provides security to transactions and not providing any security to physical attacks.

The solution for the problems from previous research as mentioned above is to develop a new ATM guard system that provide security to the ATM machines due to the physical attacks. This system performs the task same as the security officials does. The purpose of this study is to implement a security system using a cheaper single-board computer, the Raspberry pi combined with Atmega32 microcontroller and the use of mid-level and high level programming languages to write the programme.

II.   SYSTEM OVERVIEW

Fig (1) shows the system architecture. The structure of this security system is composed of seven components, which are Raspberry pi model B+ single board computer, Atmega8 microcontroller, digital vibration sensor, GSM SIM900 module, DC motor, L93D motor driver and USB camera.
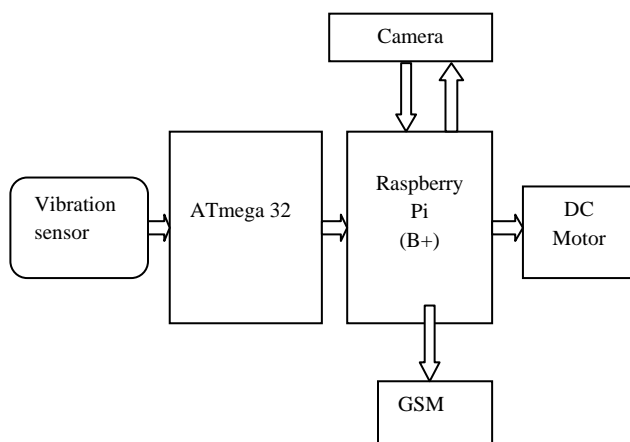

Fig (1) Blockdiagram of ATM guard system

III.   METHODOLOGY

Various steps are involved in the proposed system.
1)   Vibration sensor fluctuates the Raspberry pi. It checks for some time the vibrations.

2)   If the number of vibration exceeds for a particular time, then object detection part comes into action.
3)   Once the object is detected, then only motor part starts working .There by obtaining automatic door lock.
4)   Finally, GSM module helps to make call to the corresponding officials.

A.   Hardware description

It consists mainly of raspberry pi, digital vibration sensor, ATmega32 microcontroller, GSM module, an DC motor and USB webcam.

1.   Raspberry pi

Raspberry pi project development started on 2006. It is a single board computer developed in the United Kingdom by raspberry pi foundation, and it is intended to run linux based operating systems and an open source

prototyping platforms. Raspberry pi model B+ featuring the ARM1176 JZF-S running at 700MHZ, with 512MB of RAM is a credit card sized computer that plugs into TV and keyboard. It is a little pc which can be used for many of the things that the desktop pc does like spreadsheets, word processing and games [7] .The design is based around a Broadcom BCM835 Soc, which includes an ARM1176JZF-S 700MHZ processor, videocore GPU, and 512MB of RAM. The design does not include a built-in hard disk or solid state drive, instead relying on a microSD card for booting and long term storage.

2.   ATmega32 microcontroller

The high-performance, low-power Atmel 8-bit AVR RISC-based microcontroller combines 32KB of programmable flash memory, 2KB SRAM, 1KB EEPROM, an 8-channel 10-bit A/D converter, and a JTAG interface for on-chip debugging. The device supports throughput of 16 MIPS at 16 MHz and operates between 4.5-5.5 volts.

3.   SIM900 GSM module

The GSM shield controller used is SIM900 and it has attached to the raspberry pi. Its main function is to send SMS or make call to the corresponding police station or banking officials. The SIM900 GSM shield has low power consumption. It has its own GSM communication module and processor which is programmed using python [8].It can be utilized to send and receive SMS, voice calling and receive data packet. The AT commands is used to enable the GSM shield to send the SMS or voice calling to the recipient.

4.   Digital vibration sensor

The sensor used in this system is digital vibration sensor. It can be placed inside ATM box. This basic piezo sensor can be used in anti theft devices ,electronic locks, mechanical equipment vibration detection, sound gesture application and detection range bull's-eye counts vibration sensor occasions .These vibration levels could be given to any controller/processor and necessary decisions could be taken through it. The selection of sensor was made due to its adjustable sensitivity and vibration detection has no direction.

5.   L293D motor driver

The device is a monolithic integrated high voltage ,high current   four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays , solenoids, DC and stepper motor) and switching power transistor. So DC motor is used for automatic door lock when vibrations occur.

 A monitor, an USB keyword and a USB mouse are essential for developing the software in the raspberry pi. The complete blockdiagram of the system is shown in Fig. 2. The monitor is connected to the HDMI port of the Raspberry pi using a HDMI cable, while the keyboard and the mouse were connected to the USB ports of Raspberry pi.

B.   Software description

Raspberry pi used a linux based operating system. Python coding is used for this system. Digital vibration sensor, GSM part and motor section are programmed using python in raspberry pi. In order to detect objects using camera, OpenCV library for python was installed to enable the operation of capturing the image done by the webcam.

•   Raspbian OS

Of all operating systems Arch, Risc OS, plan 9 or Raspbian available for Raspberry Pi, Raspbian comes out on top as being the most user-friendly, best-looking ,has the best range of softwares and optimized for the raspberry pi hardware. Raspbian is a free operating system based on Debian (Linux) , which is available for free from Raspberry pi website.

•   Python

Python is widely used general-purpose , high-level programming language. Its syntax allows the programmer to express concepts in fewer lines of codes compared with other languages like C, C++ or java.
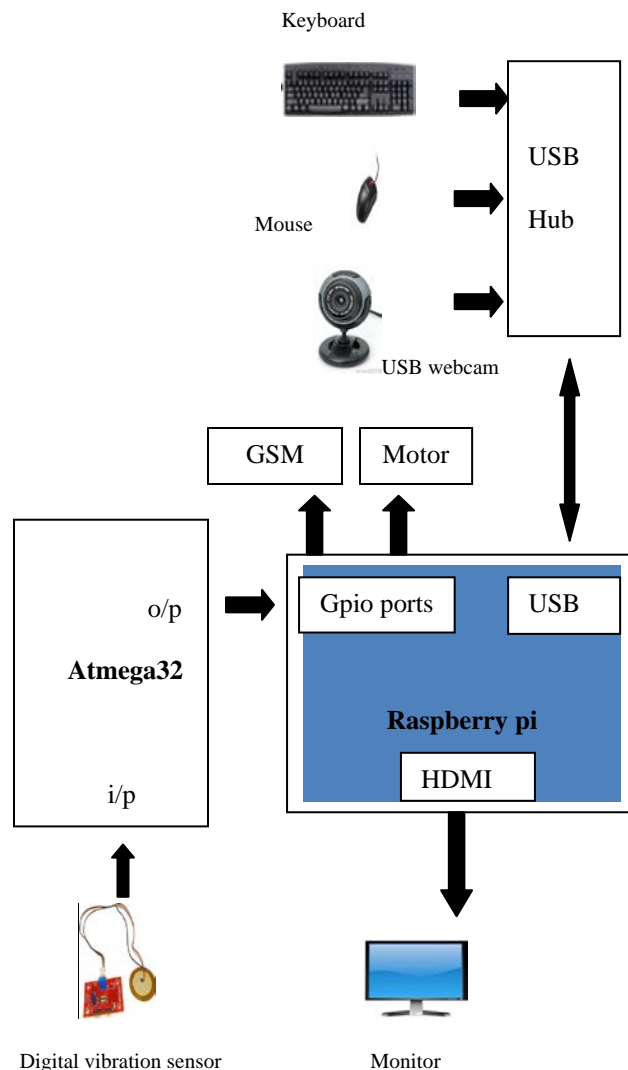

Fig (2) : Full blockdiagram of the system

•   Rpi.GPIO Python Library

   The Rpi.GPIO Python library allows to easily configure and read-write the input/output pins on the Pi's GPIO header within a python script. This package is not shipped along with Raspbian.

•   OpenCV

   It (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision. It has over 2500 optimized algorithms, including both a set of classical algorithms and the state of art algorithms in Computer Vision, which can be used for image processing, detection and face recognition. This library allows these features be implemented on computers with relative ease, provide a simple computer vision infrastructure to prototype quickly sophisticated application.

Below mentioned various steps for plugging and logging the raspberry pi on your computer. The following instruction to be done before plugging anything into raspberry pi.

➢ Begin by slotting your SD card into the SD card slot on the raspberry pi.

➢ Next, plug in your laptop or USB keyboard and mouse into the USB slots on the raspberry pi.

➢ Then connect HDMI cable from raspberry pi to the monitor or TV.

➢ When all the cables and SD card are plugged in, connect the micro usb powe supply. This action will turn on and boot your raspberry pi.

➢ Once the raspberry pi has completed the boot process, a login prompt will appear.The default login for Raspbian is username- pi with password raspberry.

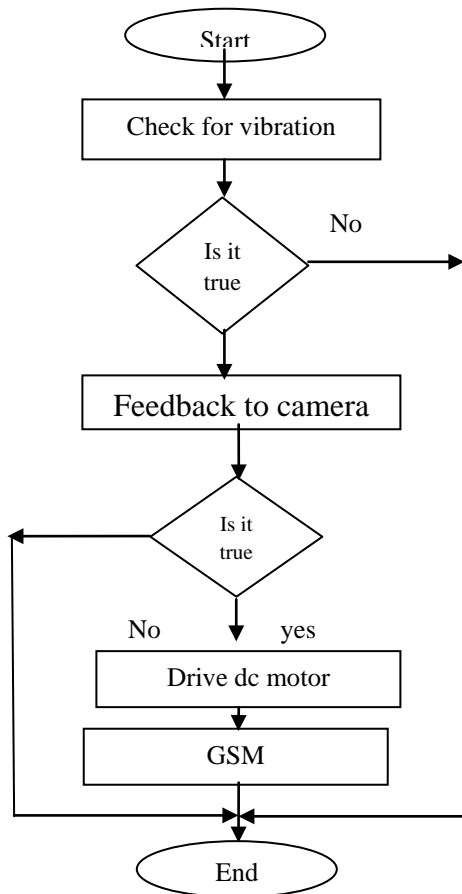➢ After the successful logging process, it shows a command line prompt-pi@raspberrypi~$

Fig (3) : The flow chart of the overall system

IV.   SYSTEM DESCRIPTION

The whole system gives the result only when vibration occurs. So it provides a security measure for the ATM centers. Fig (3) describes the flow chart of the whole system. It starts only when vibration occurs for a particular time. If it happens then system checks for the presence of objects. Then motor and gsm part is activated only when the system finds the object.

V.   CONCLUSION

This study presented the development of a security system using the Raspberry pi and Atmega32 microcontroller. The developed prototype offered a complete security to the physical attacks happening in ATM centers and can trap the thefts immediately.This system is an excellent addition to the existing ATM security system and reduce the crime in ATM centers.

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