Advanced Anti-Theft ATM Security using Raspberry Pi

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Abstract - *Automated Teller Machines ATMs are used for different ways, mostly cash withdrawals. ATM users utilize many services on ATM and they will do some billions of transactions. Meanwhile robberies occurring in the ATMs are also high with the lack of security. The main objective of our study is to minimize the robberies occurring in the ATM's. For that we have to implement a low cost standalone Embedded Web Server based on ARM11 processor and Linux operating system using Raspberry Pi. This setup is proposed for ATM security, comprising of the modules namely Door lock, web access Wi-Fi, GSM Modem, sensors and camera. Whenever robbery occurs, Vibration sensor, Fire sensor is used here which senses vibration and heat produced from ATM machine and takes necessary action. This system uses ARM7 controller based embedded system to process real time data collected using the vibration sensor. Once the vibration is sensed, information is passed to ARM11 based master device. Then the DC Motor is used to close the door of ATM, a relay will be triggered to leak the gas inside the ATM to bring the thief into unconscious stage, Camera is always in processing and it sends the images to web server and also it will be saved in computer, GSM Modem sends messages to nearby police station and corresponding bank authorities and finally an alarm sound will occurs from buzzer. This will prevent the robberies, and the person involving in the robbery can be easily carried out.*

Key Words: **Raspberry Pi 2, MEMs accelerometer, GSM, USB Camera, WI-FI router, IR sensor, DC motor, Buzzer**

1. INTRODUCTION

Automated Teller Machine (ATM) is also known as Cash Machine is an electronic telecommunication device that allows the customers to perform financial transactions, mostly cash withdrawal. As per ATM Industry Association (ATMIA) progress there are 3 million cash machines are installed in worldwide. On ATMs, the customer is identified by inserting a plastic ATM card or smart card with a magnetic stripe that contains a unique card number and some security information such as CVVC (CVV). Authentication is provided by customer entering a Personal Identification Number (PIN). Meanwhile ATM Thefts are also occurring more in the society. The cause of ATM robberies are occurs due to the lack of security present at the ATM installed machines. Though security guards are present at ATMs, robbers are keep doing the robberies by using some

technological methods. With the result of this, GOVT had losses some lakhs and crores of money.

2. STUDY OBJECTIVE

The main objective of our study is to minimize the robberies occurring in the ATM's. Here we are implementing a low cost standalone Embedded Web Server (EWS) based on ARM11 processor and Linux operating system using Raspberry Pi. This is a real time application project where we can overcome the disadvantages of present situations that are occurs in the ATMs.
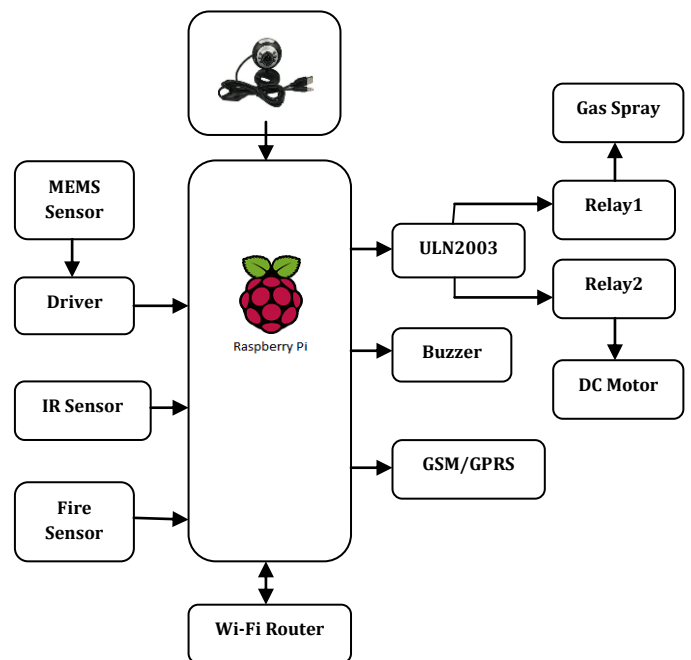
3. DESIGN OF PROPOSED HARDWARE SYSTEM

Fig -1: Block Diagram

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3. DESCRIPTION OF HARDWARE COMPONENTS

3.1 Raspberry Pi

The Raspberry Pi 2 delivers 6 times the processing capacity of previous models. This second generation Raspberry Pi has an upgraded Broadcom BCM2836 processor, which is a powerful ARM Cortex-A7 based quad-core processor that runs at 900MHz. The board also features an increase in memory capacity to 1Gbyte.The total specifications of raspberry is mention below

Fig -2: Raspberry Pi board

Raspberry Pi has Broadcom BCM2836 System on Chip. The core architecture of Raspberry pi is a Quad-core ARM Cortex-A7. Linux operating system is used in Raspberry Pi that boots from Micro SD card. It has 10/100 Base Ethernet socket connector. It supports a HDMI video output and 3.5mm jack audio output and 4*USB 2.0 connectors and 40 GPIO pins.

3.2 MEMS Sensor

Micro Electro Mechanical System (MEMS) sensor is a type of accelerometer is mainly used for monitoring the system value changes. MEMS sensor is a technique of combining electrical and mechanical components together on a chip to produce a system of miniature dimensions. It is the integration of a number of micro components on a single chip which allows the micro-system to both sense and control the environment. The MMA7660FC is a ±1.5 g 3-Axis Accelerometer with Digital Output (I2C). It is a very low power, low profile capacitive MEMS sensor featuring a low pass filter, compensation for 0g offset and gain errors, and conversion to 6-bit digital values of samples per second. The device can be used for sensor data changes, product orientation, and gesture detection through an interrupt pin (INT). The device is housed in a small 3mm x 3mm x 0.9mm DFN package. This device senses the data in XYZ coordinates.

Initially it has the some predefined values. If the user try to operate on this device it will disturbs on predefined values and process the signal corresponding to raspberry system.

3.3 IR Sensor

Here Infrared sensor is used to open the door. Whenever any obstacle passes between two IR sensors then the door will be automatically opened. IR LEDs are fabricated from narrow band hetero structures with energy gap from 0.25 to 0.4 eV. Typical forward bias is V~0.1- 1 V only.

3.4 Fire Sensor

Here we are using MQ5 smoke detecting sensor to detect the smoke/fire/gas accidents that occurs in the ATMs. It operates on a circuit voltage of 5v.

3.5 ULN2003

ULN is mainly used for interfacing between low-level circuits and multiple peripheral power loads. The ULN20XX series has high voltage, high current darling ton arrays. The driving circuitry decodes the coding and conveys the necessary data to the stepper motor. The driver makes use of the ULN2003 driver IC, which contains an array of 7 power Darlington arrays, each capable of driving 500mA of current. At an approximate duty cycle, depending on ambient temperature and number of drivers turned on, simultaneously typical power loads totaling over 230v can be controlled. Here in this proposed system we are using two DC motors ant it requires 12v. So we are using interfacing connector as ULN2003 between power load and DC motors.

3.6 USB Camera

Here we are using a USB camera to take pictures and video on the Raspberry Pi. USB cam uses 1280*720 resolutions. Whenever theft occurs in the ATM it takes the snaps and stores in the Embedded Web Server (EWS).

3.7 GSM/GPRS

GSM/GPRS modem is built with dual band sim900A works on frequencies 900/1800 MHz. The modem is coming with RS232 interface, which allows us to connect pc as well as microcontroller. The baud rate is configurable from 9600-115200 through AT commands and it has internal TCP/IP stack to enable you to connect with internet via GPRS. It is most suitable for data transfer application in Mobile to mobile interface. Some important features of GSM are listed below

- Quad-Band 850/900/1800/1900 MHz
- GPRS multi-slot class 10/8
- GPRS mobile station class B
- Control via AT commands (GSM 07.07, 07.05 and SIMCON enhanced AT commands)
- Supply voltage range is 3.4 to 4.5 V

3.8 Wi-Fi Router

Wi-Fi router is used for accessing any kind of data through wireless mode. In this system we are using a Digisol Wi-Fi router for communication. In order to communicate between Wi-Fi router and any android device/pc, first we have to know the IP address of that router. For that we have to assign IP address to the router and later we can use. It supports the wireless speed of 150Mbps, And it also supports the LAN ports and the wired Ethernet ports, Here in this proposed system we create a small embedded web server, which we can access our required data by using the communication device as Wi-Fi router.

4. WORKING PROCESS

- Initially the entrance door is closed at the ATMS.
- IR sensor is used here to opens the door. Whenever the person is passing in between IR sensors the door opens. Here we are using a DC motor to open and close the door. If a person passes in between IR sensors, it detects and sends the information to Raspberry Pi through GPIO pins. A python code is written for IR detection. If IR detects, Raspberry Pi sends the signal to DC motor via relay and the dc motor turns ON for some seconds. At the same time camera is in processing state, 4-5 snaps will be taken while the person enters and stores in the embedded web server.
- After enters in to ATM room a person need to withdrawal money or he can use some ATM services.
- A MEMs sensor is placed at the money locker area in the ATM. If a person tries to robbery he must break or cut the money locker area. Then MEMs sensor will be there to detect the vibrations and sends the signal to the Raspberry Pi.
- Then the Raspberry pi will automatically close the door and releases the unconscious spray to become thief in unconscious condition.
- Same time a message will be send to the nearest police station and corresponding bank authorities through the GSM.
- And buzzer will be there to alarm the sound to give indication to the public that the theft had occurred.

- And the camera is in always processing state and it takes the pictures at the time of MEMs detection and it stores in the embedded web server.
- A fire/smoke/gas sensor is placed in the ATMs and it sends message and sounds alarm and takes pictures whenever any fire accidents will occur.
- Images that are captured will be stored in embedded web server. For that we have to create a web server.
- The web server runs on an embedded system having limited resources to serve embedded web page to a web browser. Different software can be used to implement the embedded web server, and these are mentioned below:
  - Linux–operating system.
  - Apache – web server (http) software.
  - Mysql – database server.
  - PHP or Perl – programming languages
- Html is used for web designing which is nothing but a client web browser.
- All server side web components are dynamic web components generating dynamic web pages like php, asp.net etc.
- All client side web components are static web components generating static pages like html, java script etc.
- First we have to go in browser and then we have to enter in to the web server to see the captured images. Separate python code will be written for system application and for browser application and for web server. Here we are using Apache 2 server for web access.

5. RESULTS

1. First the overall project kit is shown in figure 3.
2. Whenever MEMs disturbed, raspberry Pi closes the door and releases the unconscious gas spray to become thief in unconscious state, and similarly GSM sends the messages to the nearby police station and to the banks, and buzzer will make sound for theft indication and camera will captures images and sends to the web server. Above all operation images are shown in below figures.
3. Similarly when the fire sensor detects, alarm will come and messages will send to the police station or bank authorities.
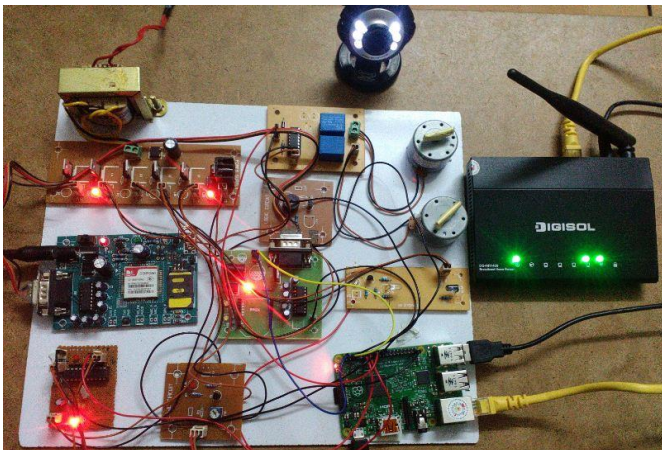4. Captured images are stored in database and we can see the images through embedded web server by using web access.
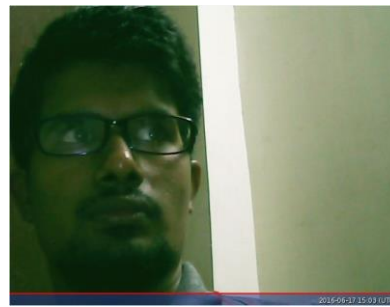
Fig -3: Overall Project Kit
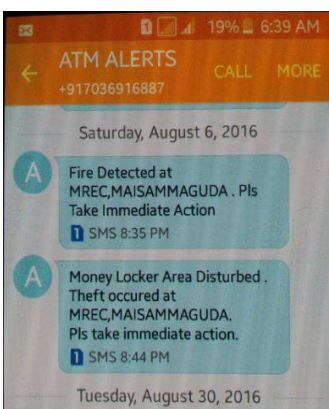

Fig -4: Html Web Browser page

Fig -5: List of Images stored in Database

Fig -6: Message alerts through GSM

Fig -7: Images captured by USB Camera

6. CONCLUSION

The project "ADVANCED ANTI-THEFT ATM SECURITY USING RASPBERRY PI" has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used and tested. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit.

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