

Detection And Monitoring Of Unauthorized Use Of Computers In The Computer Laboratory

Deepa N P, Mahesha P, Nagendra K N, Madhu G Amalazari, Sunil Kumar T

Abstract: Lab monitoring system is developed to overcome the difficulties in supervising the student activities in computer laboratories. The implementation of depicted idea helps to prevent malpractice during lab exams using Browser, Applications/Software, Pen drives and maintain the discipline during student's practical performance. In this work, Raspberry pi is used as a centralized network Server and socket programming is used to provide communication between computers and centralized network server. Keyboard and mouse theft protection is also provided for safeguarding lab belongings. The fire alarm system is an add-on to detect the presence of smoke inside the lab in case of any fire accident. Additionally, RFID based data logging system is used to store a data in an excel sheet for the Time-in and Time-out of students during the lab conduction. This work also emphasizes on surveillance of computer labs with the help of camera. The overall programming is developed using python and java. The system is capable of notifying the lab in-charge through E-mail with snaps attached to it and also through buzzer and LED light indication in case of any event or issues.

Index Terms: Detection of pen drive, Keyboard and mouse theft, Lab monitoring, Raspberry pi, RFID, Surveillance, Student log details

1 INTRODUCTION

Generally, computer based laboratories are networked through LAN. However, every laboratory may not have client server connectivity. On such systems, users can complete their given task and can also do some other work which is not permissible. Sometimes it's tough for the laboratory in-charge to supervise each and every user activity in the laboratory. So, to address issues related to the computer laboratory conduction, the detection and monitoring of systems has been developed.

2 RELATED WORK

In 2009, Ming Xue and Changjun Zhu proposed an idea based on the socket programming and software design for communication based on Client/Server [1]. In 2010, Mohd Helmy A. et.al. [2] suggested an idea on Web-based laboratory equipment monitoring system using RFID. This monitoring system enables main in-charge of the laboratory or lab technician to improve the safety of college assets. In 2015, Virginia Menezes et.al., proposed an idea of "Surveillance and Monitoring System Using Raspberry Pi and Simple CV". Now a days, Surveillance and monitoring has become important for security reasons and requires high-end surveillance systems which are expensive. The tracking and motion detection system for surveillance is discussed in [3]. An idea about a smart fire detection system was implemented using a Wireless Sensor Network (WSN) and Global System for Mobile (GSM) communication to detect fires effectively and reduce false positives in [4]. In 2017, Shakthi Murugan K.H, et. al., proposed a Security System using Raspberry Pi which emphasizes on an intelligent surveillance system that continuously monitors the targeted area, detects motion in each frame, video recording till motion is stopped and notifies the concerned authority through SMS. It highlights on the better usage of memory space since it doesn't store the entire video but stores the video only when a motion is detected. [5].

3 METHODOLOGY AND WORKING PRINCIPLE

To implement the proposed idea, Raspberry Pi is used as a main server. Raspberry Pi is a fully-featured computer on a single board and plugged to a screen. Memory card is used as storage device for Raspberry Pi and Raspbian operating system is installed in it. The block diagram of suggested system is shown in Fig. 1.

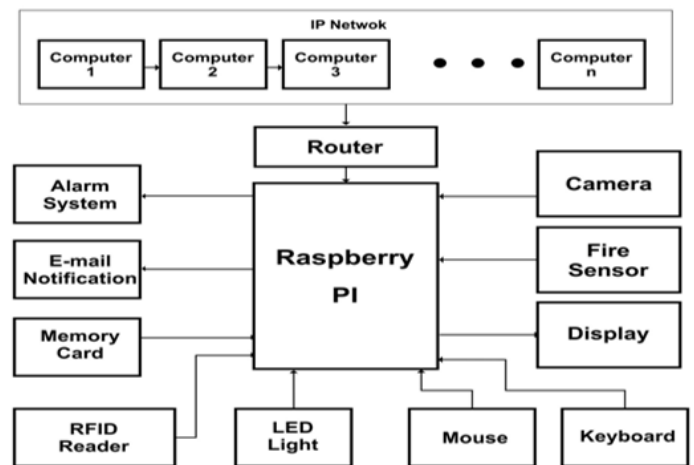


Fig. 1: Block diagram of proposed system

Key Points:

Raspberry Pi is used as a server and computers are used as clients. Memory card is used as storage device for Raspberry Pi. Keyboard and Mouse are used to operate the Raspberry Pi. Monitor is used as a display for raspberry Pi. Router is used to provide internet connection for the computers and server through LAN. Fire sensor is used to detect fire accident in the laboratory. RFID reader is used to scan the users ID cards. Camera is used to take snap of the laboratory. Email is used to send alert with snaps of the lab in case of any event or issues. LED light and buzzers are used to indicate any events or issues. Fig. 2 shows detailed connection diagram of Raspberry Pi with other modules. Raspberry pi consists of 40 pins. It has two 5V supply pins, two 3.3V supply pins and 8 ground pins. It has 16 GPIO pins. RFID reader consists of 8 pins SDA, SCK, MOSI, MISO, IRQ, GND, RST, 3.3V pins. Computers available in the laboratory are used as clients. Socket programming is used to provide communication between computers and centralized network server. It is also

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used to check for the internet connection in computers. This is done using Python and executed using PyCharm. When internet is disconnected from a client computer, it will stop sending message from client side. In server side a "connection lost" message is indicated and the source IP address is displayed on the computer. Fig. 3 shows Flowchart of checking Internet connectivity in computers. All the computers inside the lab are connected using LAN. Raspberry pi which is

used as a server communicates with the client computers with the help of socket programming. Python code is running simultaneously in Raspberry pi and as well as in computers. If the computer and Raspberry Pi communicate successfully, then green light start to blink. If the connection lost, then display the details in the monitor. Buzzer and red light turn ON

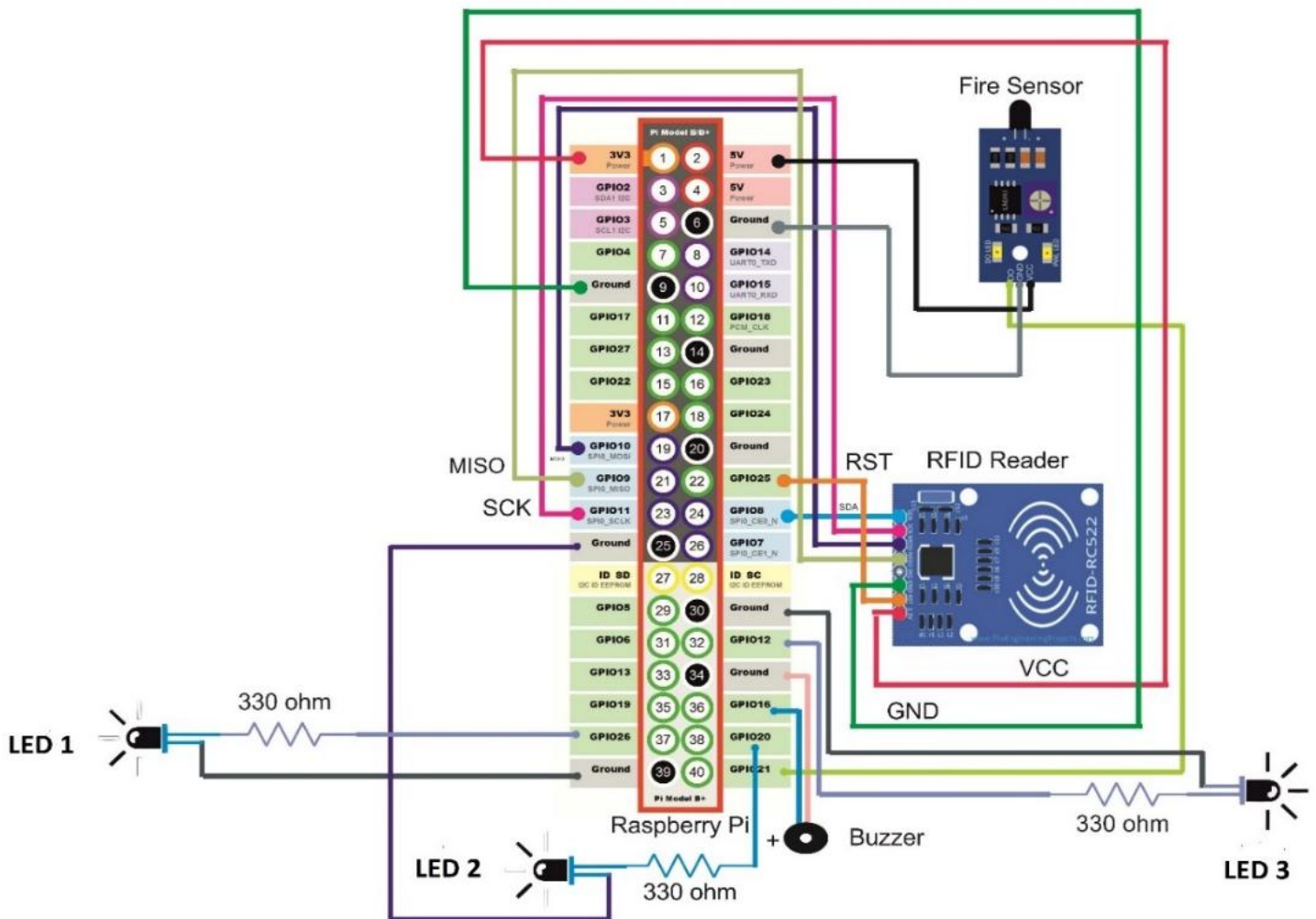


Fig. 2: Connection diagram of Raspberry Connected to other modules

Computer is a programmable machine. When any peripheral device connected to USB port of a computer, it triggers the respective device driver and it can be used as a reference for detecting pen drive when inserted or removed from computers. Here, the program will monitor the port continuously. In case any device is inserted to computer, it checks whether the device is a memory drive or not. If it is a pen drive, it compares with list of drive letter ['A' 'B' 'C' 'D' 'E' 'F' 'G' 'H' 'I'] provided in the program and sends a message (as pen drive is inserted to computer) to the server with all the details (IP address, System No., Location, etc.). If a pen drive is removed from the computer, it sends a message (as pen drive is removed from computer) to the server with all the

details (IP address, System No. Location, etc.). Similarly, every application/software installed in computers will create a process in task manager when it is opened and it has unique names of the applications. Here, the program will take a list of tasks from the task manager and compare whether the required task is present in it. If it is present, it sends a message (as "Task name" is opened in computer) to the server with all the details (IP address, System No. Location, etc.), else the process will continue. In order to do this, programs are developed using Java and executed using Eclipse IDE. Server side programs are done using Python. Java codes in the client computers will be executing. Code checks if any browser / application / software is opened. If any

of the browser/ application/ software is opened, the client computer sends a message to server. Python code in the Raspberry Pi will check for message from client. If message is received, the details are shown on display, simultaneously the buzzer and red light will be triggered and snaps are sent

through mail. Fig. 3 also indicates the flow of browser / application / software detection.

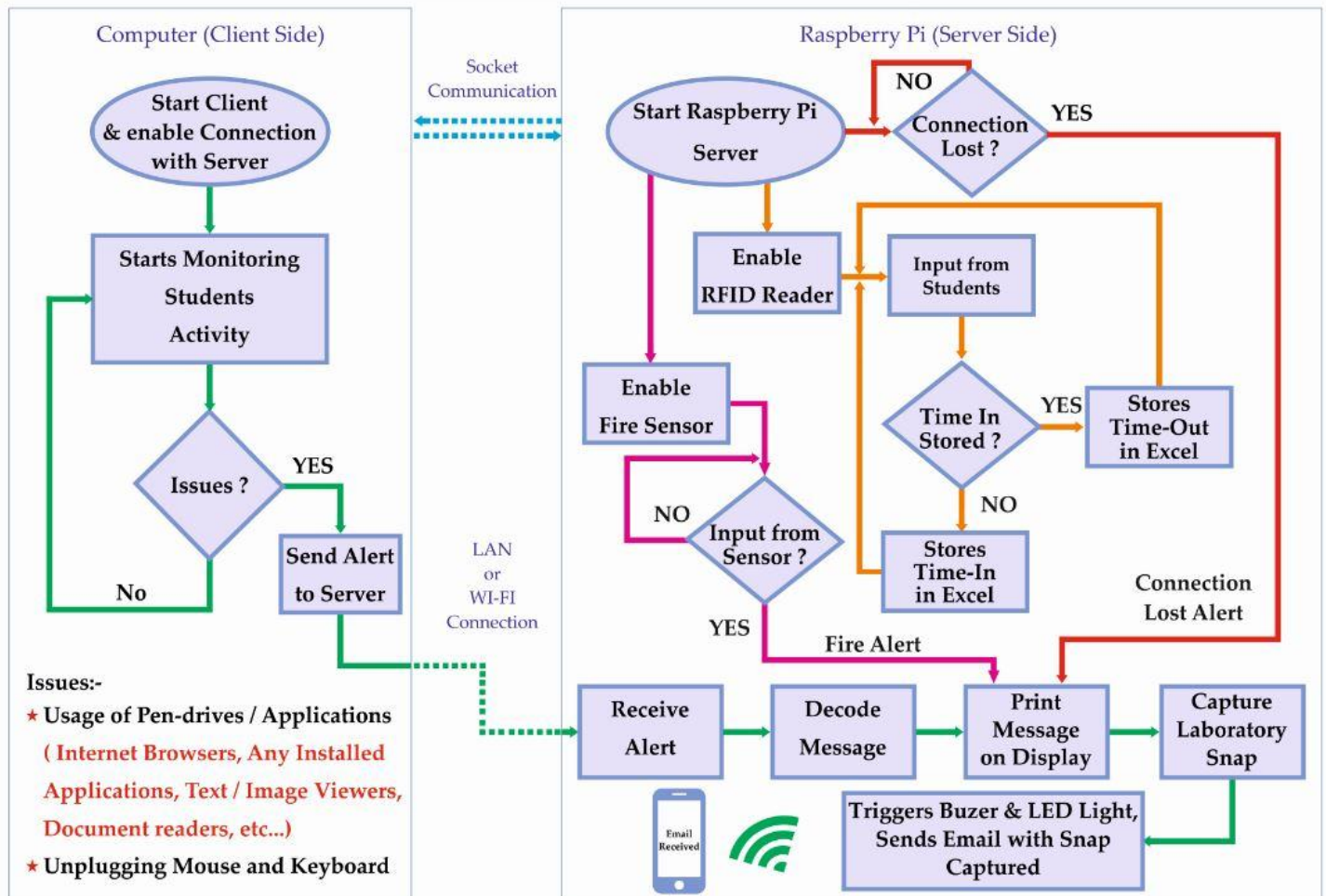


Fig. 3: Flowchart of Browser/Application/Software detection

When a Keyboard or Mouse is connected to a computer, necessary drivers will be installed in device manager and provides access to it. Each has unique driver names ('HID Keyboard Device' 'HID-compliant mouse'). The program which is developed to take care of the theft detection, will take a list of drivers from the device manager and compare it with required driver to identify its availability. If it is present, it shows as keyboard and mouse are connected to computer and process will continue else sends a message (as "Keyboard / mouse" is removed in computer) to the server with all the details (IP address, System No. Location, etc.). Fig. 3 also shows the checking of a Keyboard or Mouse removal from computer. Python code will be running in all the client computers. The code checks if there is any removal of keyboard or mouse from the computer. If there is a removal, then client computer sends message to server. The server displays that keyboard or mouse is removed from the computer and buzzer and LED light will be triggered. In addition to this, a fire accident alert is also provided in this work. Fire detector module is interfaced with the raspberry pi

and accessed using Python code. Fire detection code inside the raspberry pi will be executing. If a fire sensor detects fire, the server takes a snap of the lab and sends a mail with snap attached to it to the concerned and LED, buzzer will also be turned ON as shown in Fig. 3. Whenever server receives a message from client, it prints a received message with time details, takes a snap of the lab, LED and buzzer will turn ON and sends a mail to the concerned with snap attached to it indicating any event or issue. Additionally, RFID based data logging system is used to store the data in an excel sheet for the time-in and time-out of students during the lab conduction. This can be done using RFID tag [students ID cards] and a reader device. RFID reader is kept at the entrance of the laboratory. Fig. 3 also shows the flow of RFID based student login system. RFID reader is interfaced with Raspberry pi. To interface raspberry pi with RFID the program is written in Python. The RFID reader reads The RFID tag present in student's ID card. At first, the student has to register his ID card with the RFID reader. Whenever the student enters the lab, they have to scan their ID card with RFID reader. It stores the Time-in of the student in the excel sheet and buzzer will be

turned ON and indicates as “done successfully”. When student leaves the lab they have to tap their ID card once again to the RFID reader so that the Time-Out will be stored in the excel sheet, buzzer will be turned ON and indicates as “done successfully”.

4 RESULTS

The implementation model of proposed idea is shown in Fig. 4. The snapshots of results of the various tasks defined are shown in subsequent figures which are self-explanatory.

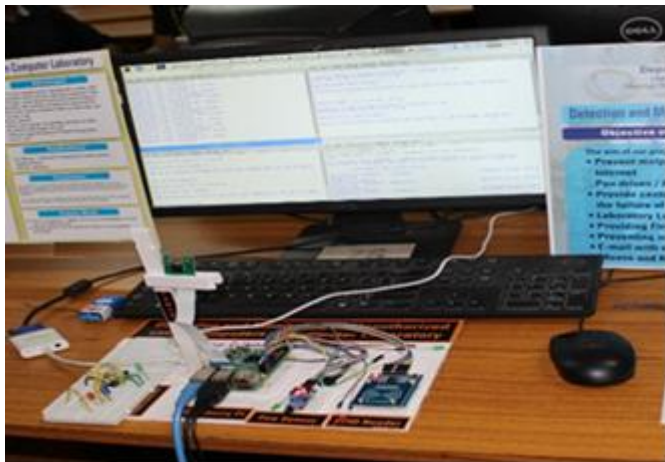


Fig. 4: Final project implementation

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DETECTION AND MONITORING UNAUTHORIZED USE OF COMPUTERS IN COMPUTER LABORATORY
.....RFID BASED TIME LOGGING SYSTEM.....

NEW STUDENT REGISTRATION

ENTER YOUR NAME & USN: MXXXXXX P           1XXXXXX17

HOLD YOUR ID CARD NEAR RFID

663619517421 MXXXXXXP           1XXXXXX17
DATA STORED SUCCESSFULLY

ENTER YOUR NAME & USN: MXXXXXXXXXXXXXI      1XXXXXX6

HOLD YOUR ID CARD NEAR RFID

225008756195 MXXXXXXXXXXXXXI      1XXXXXX6
DATA STORED SUCCESSFULLY

ENTER YOUR NAME & USN: NXXXXXX N           1XXXXXX3

HOLD YOUR ID CARD NEAR RFID

118487584490 NXXXXXX N           1XXXXXX3
DATA STORED SUCCESSFULLY

ENTER YOUR NAME & USN: SXXXXXXXXXXXXX      1XXXXXX5

HOLD YOUR ID CARD NEAR RFID
    
```

Fig. 5: Information displayed in server of new student registration

STUDENT NAME & USN	ID	Time In	Time Out
XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXX	25/08/2018 Wednesday, 24 April 2019 @ 09:35:48 AM	Wednesday, 24 April 2019 @ 09:38:27 AM
XXXXXXXXXX	XXXXXXXXXX	2487584490 Wednesday, 24 April 2019 @ 09:35:54 AM	Wednesday, 24 April 2019 @ 09:38:23 AM
XXXXXXXXXX	XXXXXXXXXX	8668761307 Wednesday, 24 April 2019 @ 09:36:02 AM	Wednesday, 24 April 2019 @ 09:38:18 AM
XXXXXXXXXX	XXXXXXXXXX	663619517421 Wednesday, 24 April 2019 @ 09:40:02 AM	Wednesday, 24 April 2019 @ 09:40:02 AM

Fig. 6: Student login details stored in excel sheet

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DETECTION AND MONITORING UNAUTHORIZED USE OF COMPUTERS IN COMPUTER LABORATORY
MONITORING INTERNET CONNECTION...

CONNECTING TO COMPUTERS
connection from ('192.168.43.121', 52779)
System No:2 Loc: Connected
connection from ('192.168.43.121', 52781)
System No:1 Loc: Connected
connection from ('192.168.43.121', 52782)
System No:2 Loc: Connected

connection lost ('192.168.43.121', 52783)
Friday 19 April 2019 @ 06:46: 41 PM
    
```

Fig. 7: Checking for internet connectivity

```

<terminated> BrowserMain [Java Application] C:\Program Files (x86)\Java\jre1.8.0_25\bin\javaw.exe (23-Apr-2019, 9:43:45 PM)
DETECTION AND MONITORING UNAUTHORIZED USE OF COMPUTERS IN COMPUTER LABORATORY

CHECKING FOR BROWSERS / APLICATIONS / SOFTWARES...

GOOGLE CHROME IS OPENED IN SYSTEM NO.: 1 LOCATION: E2 LAB 23/04/2019 09:43:45
WORD IS OPENED IN SYSTEM NO.: 1 LOCATION: E2 LAB 23/04/2019 09:43:45
EXCEL EXPLORE IS OPENED IN SYSTEM NO.: 1 LOCATION: E2 LAB 23/04/2019 09:43:45
POWER POINT IS OPENED IN SYSTEM NO.: 1 LOCATION: E2 LAB 23/04/2019 09:43:45
NOTEPAD IS OPENED IN SYSTEM NO.: 1 LOCATION: E2 LAB 23/04/2019 09:43:45
PDF READER IS OPENED IN SYSTEM NO.: 1 LOCATION: E2 LAB 23/04/2019 09:43:45
    
```

Fig. 8: Browsers, Application / software's detected – client side

```

Shell %
MESSAGE FORM ('192.168.43.121', 53482)

=GOOGLE CHROME IS OPENED IN SYSTEM NO.: 1 LOCATION: E2 LAB
Friday 19 April 2019 @ 08:30: 23 PM

SENDING ALERT OVER INTERNET.....

ACTIVITY IS SUCCESSFULLY DETECTED AND ALERT SENT TO LAB IN-CHARGE THROUGH MAIL

MESSAGE FORM ('192.168.43.121', 53560)

=WORD IS OPENED IN SYSTEM NO.: 1 LOCATION: E2 LAB
Friday 19 April 2019 @ 08:32: 19 PM

SENDING ALERT OVER INTERNET.....

ACTIVITY IS SUCCESSFULLY DETECTED AND ALERT SENT TO LAB IN-CHARGE THROUGH MAIL
    
```

Fig. 9: Browsers, Application/software's detected – server side

Fig. 8 shows details about the activity recognized in the client system and prints the details with time. The details received by the server are displayed on the monitor. The details such as browser is opened in location, system number, date and time will be displayed and the mail is sent to lab in charge about the activity as shown in Fig. 9.

```

Hardware_Main [Java Application] C:\Program Files (x86)\Java\jre1.8.0_25\bin\javaw.exe (23-Apr-2019, 9:38:33 PM)
DETECTION AND MONITORING UNAUTHORIZED USE OF COMPUTERS IN COMPUTER LABORATORY

CHECKING FOR USB PENDRIVES...

PENDRIVE HAS BEEN PLUGGED IN SYSTEM No.: 1 LOCATION: E2 LAB 23/04/2019 09:38:39
PENDRIVE HAS BEEN UNPLUGGED IN SYSTEM No.: 1 LOCATION: E2 LAB23/04/2019 09:38:40
PENDRIVE HAS BEEN PLUGGED IN SYSTEM No.: 1 LOCATION: E2 LAB 23/04/2019 09:38:41
PENDRIVE HAS BEEN UNPLUGGED IN SYSTEM No.: 1 LOCATION: E2 LAB23/04/2019 09:38:41
    
```

Fig. 10: Pen drive Plugin and removal detected – client side

```

Shell
>>> %Run ServerMian.py
DETECTION AND MONITORING UNAUTHORIZED USE OF COMPUTERS IN COMPUTER LABORATORY
.....FIRE MONITORING SYSTEM.....
FIRE HAS BEEN DETECTED
Friday 19 April 2019 @ 07:32:07 PM
SENDING ALERT OVER INTERNET.....
FIRE IS SUCCESSFULLY DETECTED AND ALERT SENT THROUGH MAIL TO LAB IN-CHARGE

FIRE HAS BEEN DETECTED
Friday 19 April 2019 @ 07:32:24 PM
SENDING ALERT OVER INTERNET.....
FIRE IS SUCCESSFULLY DETECTED AND ALERT SENT THROUGH MAIL TO LAB IN-CHARGE

MESSAGE FORM ('192.168.43.121', 53055)
=PENDRIVE HAS BEEN PLUGGED IN SYSTEM NO.: 1 LOCATION: E2 LAB
Friday 19 April 2019 @ 08:05: 30 PM
SENDING ALERT OVER INTERNET.....
ACTIVITY IS SUCCESSFULLY DETECTED AND ALERT SENT TO LAB IN-CHARGE THROUGH MAIL

MESSAGE FORM ('192.168.43.121', 53056)
=PENDRIVE HAS BEEN UNPLUGGED IN SYSTEM NO.: 2 LOCATION: E2 LAB
Friday 19 April 2019 @ 08:05: 47 PM
SENDING ALERT OVER INTERNET.....
ACTIVITY IS SUCCESSFULLY DETECTED AND ALERT SENT TO LAB IN-CHARGE THROUGH MAIL
    
```

Fig. 11: Pen drive Plugin and removal detected – server side

Fig. 10 shows the detection of pen drives when plugged in or removed from the client system. The details received by the server are displayed on the monitor and the same details are sent to mail id of lab in-charge. Details such as system no., location, date and time will be displayed in the monitor of the server as shown in the Fig. 11.

```

MOUSE IS REMOVED FROM SYSTEM NO:1 LOCATION: E2 LAB
2019-04-23 04:40:35 PM

KEYBOARD IS PRESENT IN THE SYSTEM NO.: 1 LOCATION: E2 LAB
MOUSE IS REMOVED FROM SYSTEM NO:1 LOCATION: E2 LAB
2019-04-23 04:40:47 PM

KEYBOARD IS REMOVED FROM SYSTEM NO:1 LOCATION: E2 LAB
2019-04-23 04:40:57 PM

Process finished with exit code -1
    
```

Fig. 12: Keyboard or mouse removed from the computer – client side

```

MESSAGE FORM ('172.25.20.219', 49474)
KEYBOARD IS REMOVED FROM SYSTEM NO:1 LOCATION: E2 LAB
Wednesday 24 April 2019 @ 09:50: 53 AM
SENDING ALERT OVER INTERNET.....
ACTIVITY IS SUCCESSFULLY DETECTED AND ALERT SENT TO LAB IN-CHARGE THROUGH MAIL

MESSAGE FORM ('172.25.20.219', 49475)
MOUSE IS REMOVED FROM SYSTEM NO:1 LOCATION: E2 LAB
Wednesday 24 April 2019 @ 09:51: 08 AM
SENDING ALERT OVER INTERNET.....
ACTIVITY IS SUCCESSFULLY DETECTED AND ALERT SENT TO LAB IN-CHARGE THROUGH MAIL
    
```

Fig. 13: Keyboard or mouse removed from the Computer – server side.

The identification of disconnection of keyboard and/or mouse connected to the computer is shown in the Fig. 12. Details received from the client is displayed in the server and the same details are sent to mail id of lab in charge. Details such as system no., location, date and time will be displayed in the monitor of the server as show in the Fig. 13.

```

DETECTION AND MONITORING UNAUTHORIZED USE OF COMPUTERS IN COMPUTER LABORATORY
.....FIRE MONITORING SYSTEM.....
FIRE HAS BEEN DETECTED
Friday 19 April 2019 @ 07:32:07 PM
SENDING ALERT OVER INTERNET.....
FIRE IS SUCCESSFULLY DETECTED AND ALERT SENT THROUGH MAIL TO LAB IN-CHARGE

FIRE HAS BEEN DETECTED
Friday 19 April 2019 @ 07:32:24 PM
SENDING ALERT OVER INTERNET.....
FIRE IS SUCCESSFULLY DETECTED AND ALERT SENT THROUGH MAIL TO LAB IN-CHARGE
    
```

Fig. 14: Details displayed on monitor when fire is detected

If in case any short circuit inside the lab, the fire detector detects the fire and the snap of the lab environment and information of date and time when the fire got caught is sent to the lab in charge as shown in the Fig. 14.

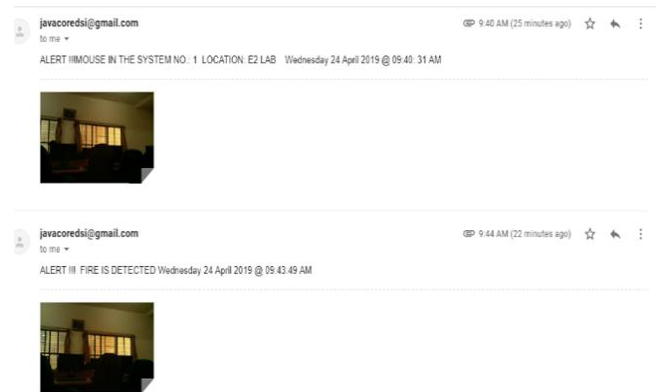


Fig. 15: Snap sent through E-mail when mouse is removed and when fire is detected

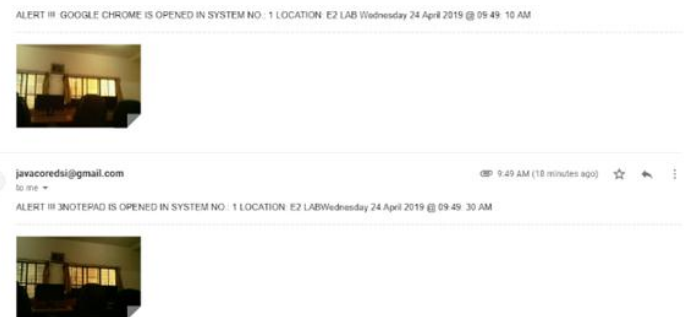


Fig. 16: Snap sent through E-mail when pen drive is plugged in or unplugged

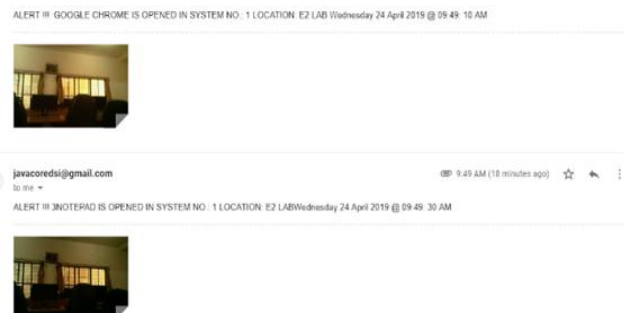


Fig. 17: Snap sent through E-mail when Browser's, Application's / Software's are opened

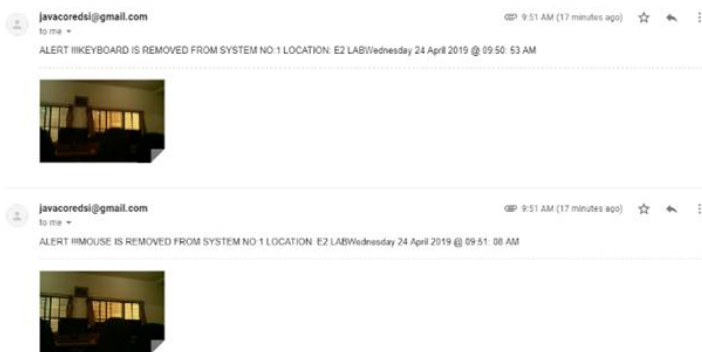


Fig. 18: Snap sent through E-mail when mouse and/or keyboard is removed in client computer

Fig. 15, Fig. 16, Fig. 17, Fig. 18 shows the email sent to lab in-charge in case of any events or issues such as fire detection, pen drive is plugged-in or unplugged, Browser's / Application's / Software's is opened, mouse or keyboard is unplugged from the client computer.

5 CONCLUSION

In colleges, it is tough for a faculty or laboratory in-charge to supervise every student activity during conduction of laboratory. This project will address the issues related to detection and monitoring of unauthorized activities in the laboratory and also to prevent malpractice, maintain the discipline during student's practical performance. It helps in maintaining the students time in/out details, detection of Pen drive insertion or removal from the computer, usage of Browsers, Applications / Software's, removal of Keyboard and mouse from the computer, Internet disconnection etc. during lab conduction. The project helps the Lab in-charge to supervise the student's activity by sitting in front of Central main computer. There is no need of continuous video recording as the system is capable of sending snap of the lab with all required details only in case of any event or issue. Some of the limitation to mention are, server need to be turned on first, later the client computer needs to be switched on. Secondly, when internet is disconnected, due to delay, the server sometimes does not trigger the buzzer and LED light, without internet, client and server are not able to communicate. In future, the project can be improved with attendance system using Face detection, or Fingerprint detection.

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REFERENCES

- [1] M. Xue and C. Zhu, "The Socket Programming and Software Design for Communication Based on Client/Server," *2009 Pacific-Asia Conference on Circuits, Communications and Systems*, Chengdu, pp. 775-777, 2009. DOI: 10.1109/PACCS.2009.89
- [2] M.H.A. Wahab et al., "Web-Based Laboratory

Equipment Monitoring System Using RFID," *2010 International Conference on Intelligent and Advanced Systems*, Manila, pp. 1-5, 2010. DOI: 10.1109/ICIAS.2010.5716177

- [3] V. Menezes, V. Patchava and M. S. D. Gupta, "Surveillance and Monitoring System Using Raspberry Pi and SimpleCV," *2015 International Conference on Green Computing and Internet of Things (ICGCIoT)*, Noida, pp. 1276-1278, 2015. DOI: 10.1109/ICGCIoT.2015.7380661
- [4] K. Deve, G. Hancke and B. Silva, "Design of A Smart Fire Detection System," *IECON 2016 - 42nd Annual Conference of the IEEE Industrial Electronics Society*, Florence, pp. 6205-6210, 2016. DOI: 10.1109/IECON.2016.7794000
- [5] K.H.S. Murugan, V. Jacintha and S. A. Shifani, "Security System Using Raspberry Pi," *2017 Third International Conference on Science Technology Engineering & Management (ICONSTEM)*, Chennai, pp. 863-867, 2017. DOI: 10.1109/ICONSTEM.2017.8261326