Protection of Movies From Camcorder Piracy

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Abstract- *Today piracy is one of the most important problem that the owners of multimedia contents are facing now. The copy right protection for digital media becomes an important problem of piracy. Camcorder piracy has adverse effects on the movie industry. There are many methods to prevent recording in theater, but no recognized technology satisfies the need of defeating camcorder piracy as well as having no effect on the audience. This paper presents a new projector display technique to defeat camcorder piracy in theater using infrared light. This technique is developed to render any recording unwatchable by flashing pulses of infrared light from behind the cinema screen. The pulses pass through tiny holes in the screen originally design to allow through sound, and cause interference to any video cameras held by members of the audience in theater.*

Keywords- Camcorder piracy, Infrared light, Cinema screen (projection screen).

I. INTRODUCTION

Movie piracy has an intense effect on the movie industry. Motion Picture Association of America (MPAA) [1] conducted an investigation on the movie piracy in 2005. Digital Rights Management (DRM) is used by content distributors to restrict the way in which content may be used, transfer, and stored by users. In the view of the law, movie piracy is considered as crime all over the world and has a profound impact on a wide range of economy. One major source of movie piracy is the camcorder piracy or cams, i.e. movies recorded by portable devices inside theaters. Yet, as of today, cams are still widespread over the internet or sold as DVDs in flea markets, many of which having been recorded in a US theater. While watermarking can help finding out in which theater a cam has been recorded, actual camcorder-jamming methods must still find its way onto movie theaters to prevent the illegal action from taking place, or at least make cams look so bad that no one would be willing to watch them. Of course content alterations should remain unnoticeable for the audience in the theater.

According to the BBC news the camcorder piracy accounted for about 23% of the piracy methods [2]. Watermarking techniques are created with the advent of Digital Cinema (DC) [9]. Cam and Telesync are the two types of camcorder piracy [3]. Digital watermarking is the process of identifying information within a host multimedia object like a video. However, watermarking techniques cannot block or defeat camcorder piracy. There are different kinds of existing methods to prevent video recording in movie theaters technically [4]. There are mainly three categories of anti-camcording methods:

First method is to project invisible light from the screen to the whole audience [5]. This Second method is to locate the camera and block the camera from illegal recording. These methods use a scanning light beam, transmitted from the main screen area towards the audience and reflected back from shining objects.

Third, there are methods based on the concept of spatiotemporal modulation of the light [7], [8]. The basic idea is to create temporal aliasing artifact in the recorded movie using the mismatch between display frequency and camera sampling frequency. The modulation should be carefully designed that the displayed movie does not contain any noticeable visual artifacts**.**

II. EXISTING SYSTEM

Camcorder piracy has been a great trouble to the film industry. Majority of the producers face this problem. Many technologies are developed to reduce the movie piracy via camcorders.

Initially guards were made to stand inside the theatre during the telecast of the movie. These guards were provided with infrared enabled eyeglasses. These eyeglasses helped them to find the person who recorded the movie. But this in turn affected the privacy of the audience. So this method was dropped.

Then another technology was developed to reduce the bootlegging of movies. Here extra frames were added in between the original frames of the movie. that is, each second of the movie contains 24 frames. A 25th frame was added in between each second. This 25th frame consisted of a watermark of the theatre and a picture saying “illegal” copy”. These frames cannot be identified by the human eye. So when a camera records the movie, these extra frames distort the

video and when the person uploads the movie online, he gets caught. But adding these extra frames was found to be a hectic process. Adding extra frames throughout the length of the movie consumed more time. So this method also did not succeed.

The pirates always had a new way of pirating the movie. The websites that were used to sell the pirated movies were also blocked. But the pirates came up with new proxy websites. So online piracy also became a great threat to film industry.

III. PROPOSED SYSTEM

The proposed "protection of movies from camcorder piracy" is a system to protect movies from being bootlegged. The project describes the technique to render any recording unwatchable by flashing pulses of infrared light from behind the cinema screen. Here, the infrared pulses passes through the tiny holes in the screen which is originally design to allow sound through it and cause interference to any video cameras held by members of the audience. The infrared light which is invisible to human eyes, is impossible to filter out rendering the recording too blurry to watch. The best results are achieved at speed of 10 pulses per second. The ATmega328p microcontroller is used for the purpose of blinking infrared pulses behind the screen.

IV. LITERATURE SURVEY

The paper entitled "Defeating Camcorder Piracy by Temporal Psychovisual Modulation" deals with a new video projection technique to defeat camcorder piracy in movie theaters using the newly emerged display paradigm of temporal Psychovisual modulation. The technique exploits the difference in image formation mechanisms between human eyes and digital cameras: in the human visual system, images are formed via continuous integration of the light field, whereas digital video acquisition is based on discrete sampling of light sensors Here camera jamming algorithm is used to design optical signals emitted by the high speed projector for the objective of defeating camcorder piracy while maintaining visual transparency to theater audience [3].

The paper entitled "Flicker Forensics for Private Devices Identification" deals with Cryptography-based protection of movies. It is an efficient means to protect multimedia content during transport. Nevertheless, content is eventually decrypted at rendering time, leaving it vulnerable to piracy e.g. using a camcorder to record movies displayed on an LCD screen. Such type of piracy naturally imprints a visible flicker signal in the pirate video due to the interplay between the rendering and acquisition devices. The parameters of such flicker are inherently tied to the characteristics of the pirate devices such as the back-light of the LCD screen and the read-out time of the camcorder. A forensic methodology is introduced to estimate such parameters by analyzing the flicker signal present in pirate recordings [6].

V. HARDWARE DESIGN

ARDUINO UNO (ATmega328p)

The Arduino Uno is a microcontroller board based on the ATmega328p. It has 14 Digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions.

ELECTROMAGNETIC RELAY

Electromagnetic relays are switching devices that utilize induction to perform a specific task within an electrical circuit or system. The electromagnetic phenomenon is used to create a magnetic field, which is then focused and used to open or close circuits and even perform mechanical circuits. An electromagnetic relay uses the principle of induction to control electronic circuits and devices. A coil of wire sets up a magnetic field that is concentrated around a core. This magnetic field is used to physically open and close circuits for mechanical work. One of the key advantages of electromagnetic relays is that they are electrically and physically separate from the circuits they control.

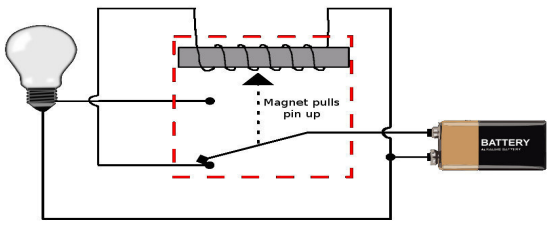

Figure 1. ELECTROMAGNETIC RELAY

INFRARED LED

Infrared LED emits infrared light, means it emits light in the range of Infrared frequency. We cannot see Infrared light through our eyes, they are invisible to human eyes. The wavelength of Infrared (700nm – 1mm) is just beyond the normal visible light. Everything which produce heat, emits infrared like our human body. Infrared have the same properties as visible light, like it can be focused, reflected and polarized like visible light. Other than emitting invisible infrared light, IR LED looks like a normal LED and also operates like a normal LED, means it consumes 20mA current and 3vots power. IR LEDs have light emitting angle of approx. 20-60 degree and range of approx. few centimeters to several feet's, it depends upon the type of IR transmitter and the manufacturer. Some transmitters have the range in kilometers. Infrared Emitting Diode (IR333-A) is a high intensity diode, moulded in a white transparent plastic package. The device is spectrally matched with phototransistor, photodiode and infrared receiver module

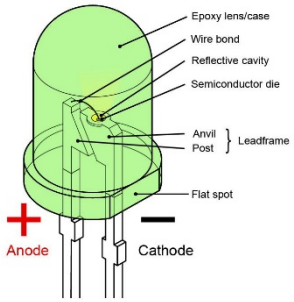

Figure 2. IR LED

VI. DESIGN IMPLEMENTATION

The IR illuminator is placed behind the screen. The IR Illuminator is based around our IR LED connected in series on PCB which holds a total of 25 LEDs on a rectangular PCB. The board is equipped with 25 special IR LEDs which do all of the work, along with 5 current limiting resistors. Similarly four more IR illuminators are prepared. There are two common frequencies available, one at 940nm and the other at 850nm. The most commonly used frequency with black and white CCD cameras is the 940nm. 850nm LEDs produce a very slight red glow when operating, which is visible to the human eye. 940nm models produce no visible light to the eye. Once all the IR LED's are assembled, power to the circuit is needed and it is given by 9v DC battery for all five IR illuminator circuits and one IR illuminator is connected to the Arduino board with ATmega328p microcontroller. The ATmega328p microcontroller is used for the purpose of blinking infrared pulses behind the screen and an electromagnetic relay 5v is also used. These five IR illuminator circuits are placed behind the screen.

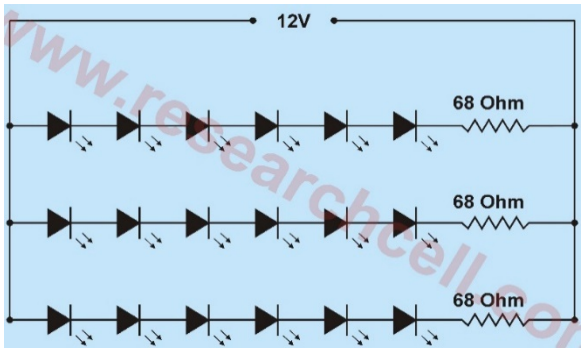

Figure 3. IR ILLUMINATOR

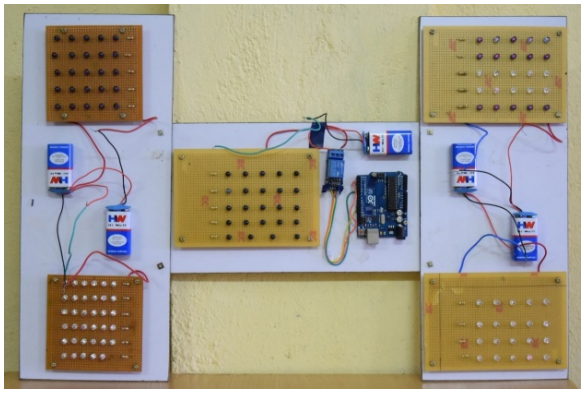

Figure 4. HARDWRE IMPLEMENTATION

VII. ADVANTAGES

The implementation of this system is reliable and cost effective. The final output is a video having infrared pattern merged with the original video, which makes the user unable to watch the pirated video. The advantage of using infrared is that the camera can be blocked easily from recording. The losses caused by piracy can be minimized and the purchase of pirated videos will get reduced.

VIII. RESULTS

The following are the results that are obtained by the hardware implementation in this project. The movie's playback is distorted by placing the hardware behind the screen on which the movie is being played. The Infrared LEDs in the hardware flicker at a rate of 10 pulses per second. The electromagnetic relay switches ON and OFF 10 times for each second. The flickering passes through the tiny holes in the screen. When recorded using a camera, the movie will get distorted. The movie appears to be normal to the human's vision. The camera could not record the movie properly.

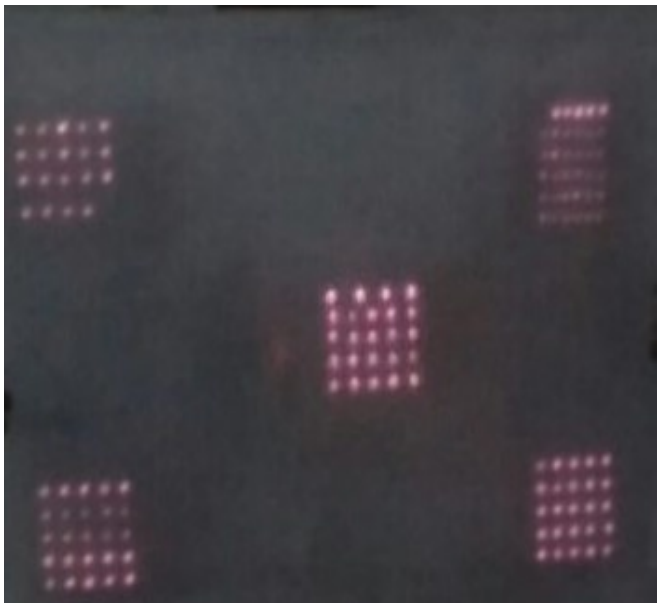

Figure 5. FINAL OUTPUT

IX. CONCLUSION

Protection of movies from camcorder piracy was developed to benefit the IMPPA – Indian Motion Pictures Producers' Association. The movies are being bootlegged and sold in the market. The movies are recorded in the theatres using the camera and then sold in the market. The people who are responsible for the production of this movie and the one who telecasts them in the theatres face huge loss due to this kind of piracy. The ARDUINO program was coded and dumped into the ARDUINO microcontroller board. This program makes the Infrared LEDs to flicker at a rate of 10 pulses per second. The flickering distorts the movie when recorded using a camera. Thus, the movie theatre owners and the producers of the movie are greatly rescued from a huge loss. This prototype was designed using Infrared LEDs of wavelength 940nm. This radiation does not affect the general audience. The movies can be protected from being pirated at a lower cost by the use of this technology.

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