IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 2, June 2024

Movie Piracy Reduction using Automated Infrared Transmitter Screen System and Steganography Technique

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Abstract: *Cinema is the major entertainment of people in today's life. To lock in people a allocate of theory is put on cinemas by the film – makers. Their effort is being crushed by few people by stealing the cinema substance. They do it by capturing the video in flexible camera and exchange it to websites or offer it to people and this goes on. In this expand, a specialized procedure to dodge video recording in movement picture theaters is shown. An subtle light is expected from the screen to the total bunch of spectators that falls on the cameras which are optically unstable to infra-red light in turn disturbing the securing capacities of any camera making an illegal recording inside the theater pointless. These days, camcorder burglary has exceptional influence on the development picture industry. In spite of the reality that some watermarking innovations can track the movement picture privateer, the video substance seen inside the theater may be impacted and they cannot dishearten the require of stolen movement picture since the watermarks in appropriated moves are undetectable. This wander presents a advanced procedure to overcome camcorder burglary and realize substance security inside the theater utilizing a advanced worldview of information appear development, called Common Psycho visual Adjust (TPVM), which utilizes the contrasts between the human-eye acknowledgment and progressed camera picture- forming to stack an imperceptible plan on computerized screen and projector. The pictures formed in human vision are diligent integration of the light field, while discrete assessing is utilized in progressed video securing which has "blackout" period in each reviewing cycle. Based on this differentiate, we'll break down a movement picture into a set of appear traces with particular plans and broadcast them out at tall speed so that the gathering of individuals cannot take note any unsettling impact, while the video traces captured by camcorder will contain exceedingly frightful artifacts (i.e., the plans). The plan embedded inside the movement pictures can in addition serves as taking after information to reveal the one obligation for the camcorder burglary*

Keywords: Node MCU, Arduino UNO, GSM module, IR Transmitter, Embedded C, pythonIDE, OpenCV

I. INTRODUCTION

In today's age the development of the Web has driven to numerous modern advancements within the way it is utilized. Web can give quick get to any kind of information and media, conjointly the copyrighted substance. "Piracy alludes to the unauthorized duplication of copyrighted substance that's at that point sold at significantly lower costs within the 'grey' market". Last duplicate of the motion picture substance might get spilled some time recently its discharge by the numerous groups working on them. The more common strategy is to film the motion picture interior a theater and after that uploading it on Websites or convert them to DVDs and offer them on the roads. Most box office discharges are accessible online inside a number of days or even hours of the box office discharge.

Preventing robbery has continuously been need number one for motion picture theaters. The markets around the world have attempted to require on the issue of robbery through policing and indictment. Copyright law secures the esteem of creative work. Making unauthorized duplicates may subject one to respectful and criminal liability.

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Night vision goggles are given to motion picture lobby staffs which would offer assistance them to take note any group of onlookers attempting to record a motion picture whereas screening. Instead of treating each motion picture goes as a potential privateer, an anti-piracy screening framework can be executed in order to create the privateer duplicate futile as well as having no effect on the audience. Motion picture robbery incorporates a significant effect on the movement picture industry. The Movement Picture Affiliation of America (MPAA) [1] conducted an examination on the motion picture robbery in 2005. Concurring to the measurements within the report, the major U.S. movement picture studios lost 6:1 billion or more yearly. These misfortunes in income will clearly cause genuine financial issues for the studios and indeed contribute to their current downfall. In 2010, for example, over one million duplicates of James Cameron Avatar were downloaded wrongfully in fair seven days [2]. Within the see of the law, movie robbery is considered as wrongdoing all over the world. As a critical source of motion picture robbery, the camcorder robbery accounts for almost 23% of the robbery strategies agreeing to the BBC News [3]. As the source of encroaching DVDs, camcorder motion pictures spread quickly on the internet.

II. METHODOLOGY

2.1 System Architecture

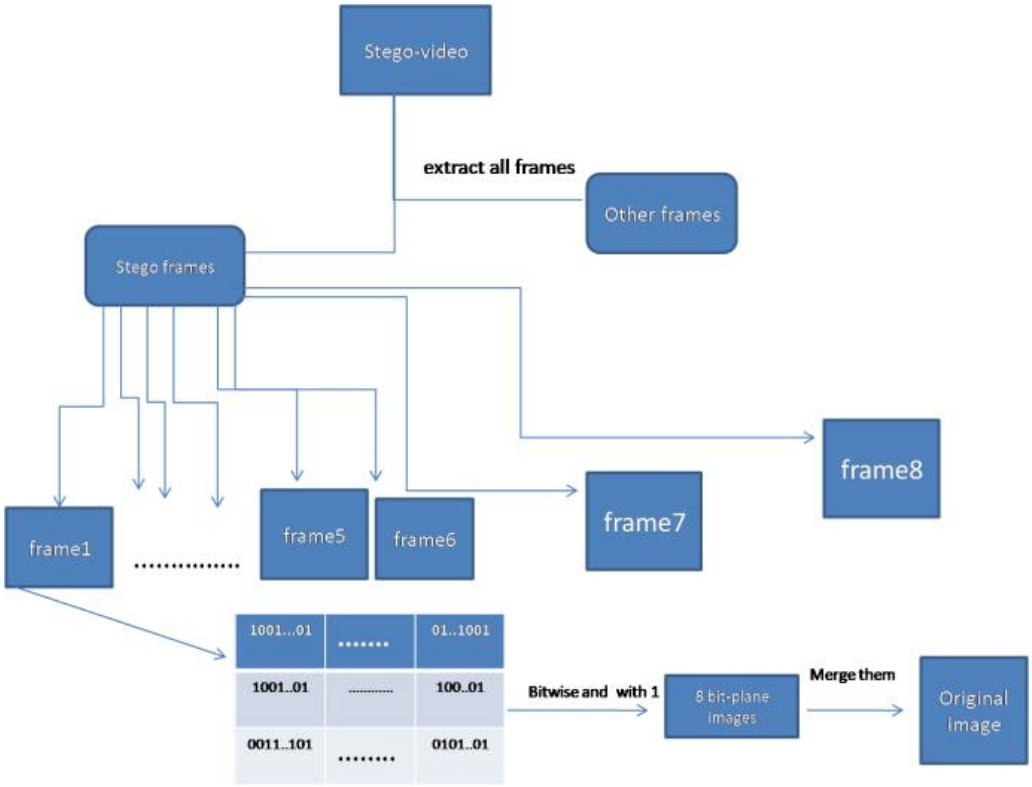

Figure:1 System Architecture

Figure show the 1 system Architecture for Video record is by and large a collection of pictures and sounds, so most of the displayed strategies on pictures and sound can be connected to video records as well. So, video steganography is nothing but a combination of picture and sound steganography. So, the combined assessments i.e., the assessments for picture and sound steganography can be taken together for the assessment of video steganography. The incredible focal points of video are the expansive sum of information that can be covered up interior and the reality that it could be a moving stream of pictures and sounds. A video stream comprises of collection of outlines and the mystery information is inserted in these outlines as payload. The target string length should be multiple of four something else a few less utilized special character is concatenated at the conclusion to

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create string length as different of four. For preprocessing each character of target string changed over to their comparing ASCII as well as 7 bit parallel. At that point each 4 bits are cut and changed over into hexadecimal digits. Let the string is "Secret" whose length is 6. "" is included to form its length different of four. So the string gets to be "Secret"". The ASCII of the characters of this target string is 83, 101, 99, and 114 and …, individually and their comparing 7 bit twofold is 1010011 1100101 1100011 1110010…. After concatenating it gets to be 10100111100101110001111110010… At that point the hexadecimal digits are A 7 9 7 1 F 2 …

Presently these hexadecimal digits are embedded into the cover video by altering sufficiency values of the target tests. The amplitudes of cover video are partitioned by At that point the leftovers are compared with the target hexadecimal digits and the amplitudes of the cover video are balanced in such a way so that the leftover portion is rise to with the target hexadecimal digits. For extricating the target information from stegovideo at the collector side to begin with the string length is extricated from to begin with 16 amplitudes by standard LSB extraction procedure. At that point the taking after steps are to be taken after: At the receiver side the influenced (where the information is hidden) plentifulness values are isolated by 16 and the leftovers of this division are covered up hexadecimal digits. Presently usually send to the post-processing method to induce the initial target content. Now the resultant hexadecimal digits are changed over to their 4 bit binary equivalent. Each of these 4 bits is concatenated to make a twofold string. At that point each 7 bits are cut and converted to their comparing decimal comparable. The characters of these ASCII values are concatenated as per the string length to induce the first target string.

2.2 Principle of Operation

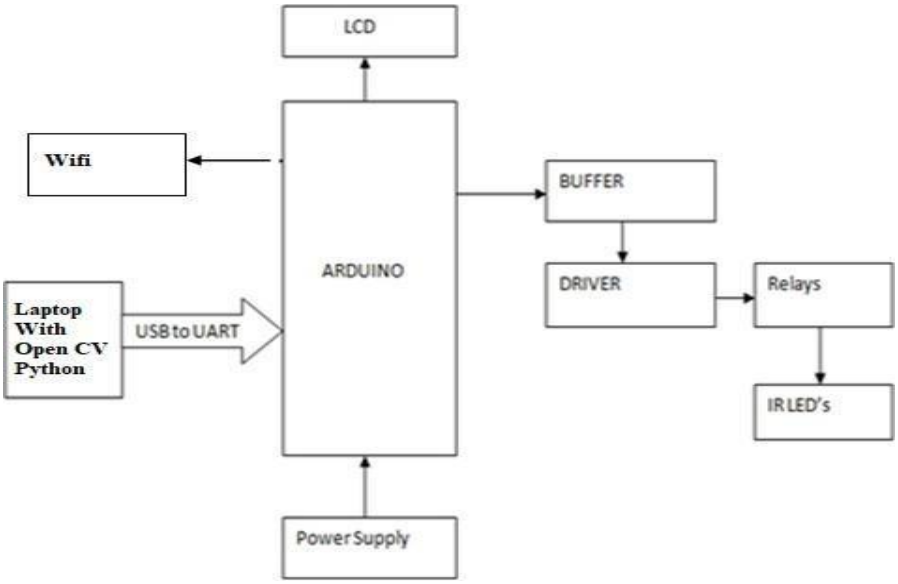

Figure 2: Block Diagram

The square graph of the motion picture robbery framework utilizing video steganography is appeared within the Figure 2 Arduino Uno, is the heart of the framework. It controls the lion's share operations of the framework utilizing Atmega microcontroller. Arduino is scripted by the Arduino IDE program. Video steganography is done utilizing Python software. The framework works within the taking after way.

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On exchanging on the Arduino Uno miniaturized scale controller as appeared within the figure.3. A The keypad gets enacted for the secret word to be entered. In case the secret word is confirmed the controller yield is given to the driver through the buffer which gives impedance coordinating between them. Since the yield from the miniaturized scale controller is moo, driver intensifies the flag and incites the transfers to control the IR LEDs. The signals that are transmitted by IR LEDs set behind conjointly along the edge of the screen are radiated towards the gathering of people. So this undetectable light irritates the securing capacities of the camera.On setting IR LEDs behind and around the screen as in figure 3. B within the cinema theater, the video playing on the screen gets to be obscure or mixed. Hence, the gathering of people will be able to observe the motion picture without any unsettling influence but since the camcorders are touchy to IR light the recorded substance gets to be obscure or unfit to observe as infigure3.B.

Figure:3. A. Normal picture

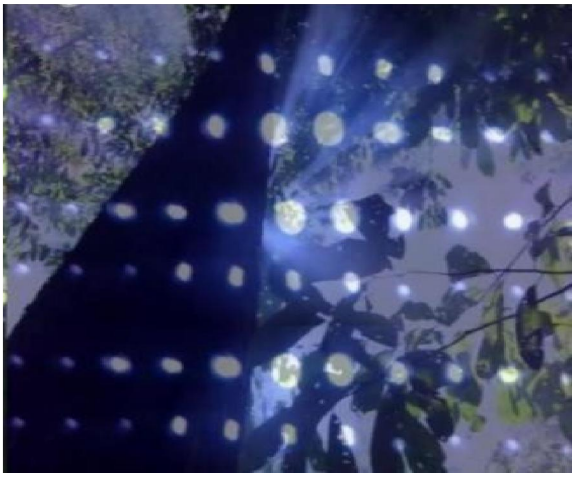

Figure:3. B. Picture after placing IR's behind and around the screen

III. SYSTEM REQUIREMENT SPECIFICATION

3.1 Hardware Requirements

- Arduino Uno - The Arduino Uno is a popular microcontroller board based on the ATmega328P. It's designed for beginners and hobbyists to create electronic projects. It features 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, and an ICSP header. The Uno is programmable with the Arduino IDE, which uses a simplified version of C++. It supports various shields and sensors, making it versatile for projects ranging from simple LED blinkers to complex home automation systems. Its ease of use and extensive online community support make it ideal for learning and prototyping.
- IR transmitter - An IR transmitter, or infrared transmitter, is a device that emits infrared light to communicate wirelessly with other electronic devices. It operates by sending encoded signals via infrared light, which are detected by an IR receiver. Commonly found in remote controls for televisions, air conditioners, and other home appliances, IR transmitters use LEDs to produce the infrared light. These signals are modulated to carry specific commands, which the receiver decodes to execute functions such as changing channels or adjusting volume. The technology relies on line-of-sight, requiring a clear path between the transmitter and receiver for effective communication.
- Relay Boards - Relay boards are electronic boards containing relays and switches, with input and output terminals for controlling voltage distribution. They provide customizable control for numerous relay channels simultaneously, allowing real-time adjustments.
- WiFi module - A WiFi module is a device that enables wireless connectivity for electronic systems, allowing them to communicate over WiFi networks. It integrates a microcontroller and a wireless transceiver, often adhering to IEEE 802.11 standards. Commonly used in IoT applications, smart home

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devices, and industrial automation, WiFi modules facilitate internet access, data transmission, and remote control capabilities without the need for wired connections.

3.2 Software Requirements

- Arduino IDE - The Arduino Integrated Development Environment (IDE), also known as Arduino Software, includes a code editor, message area, console, toolbar, and menus. It interfaces with Arduino hardware for program uploading and communication.
- Python IDE - A Python Integrated Development Environment (IDE) is a software application that provides comprehensive facilities to computer programmers for Python development. An IDE typically includes a source code editor, build automation tools, and a debugger. Examples include PyCharm, VS Code, and Jupyter Notebook. These tools streamline coding, debugging, and testing, enhancing productivity and code quality.
- OpenCV - OpenCV (Open Source Computer Vision Library) is a powerful, open-source library designed for real-time computer vision and image processing. It provides various tools and functions for tasks like image recognition, object detection, facial recognition, and camera calibration. Widely used in AI, robotics, and computer vision applications, it supports multiple programming languages.
- Embedded C – Embedded C is a programming language extension of C designed for developing software for embedded systems. It provides low-level access to hardware and supports real-time constraints. Embedded C includes standard C language features plus additional functionalities like direct hardware manipulation, fixed-point arithmetic, and memory management, making it suitable for microcontroller programming.

IV. IMPLEMENTATION

4.1 Object oriented design

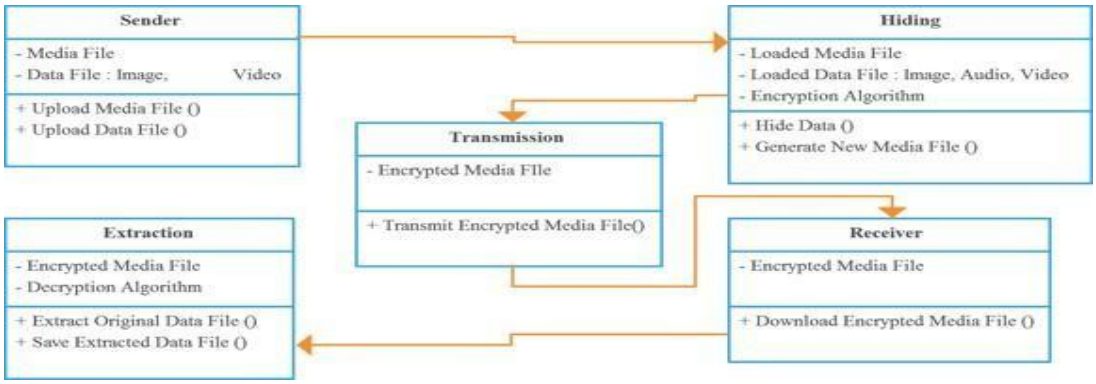
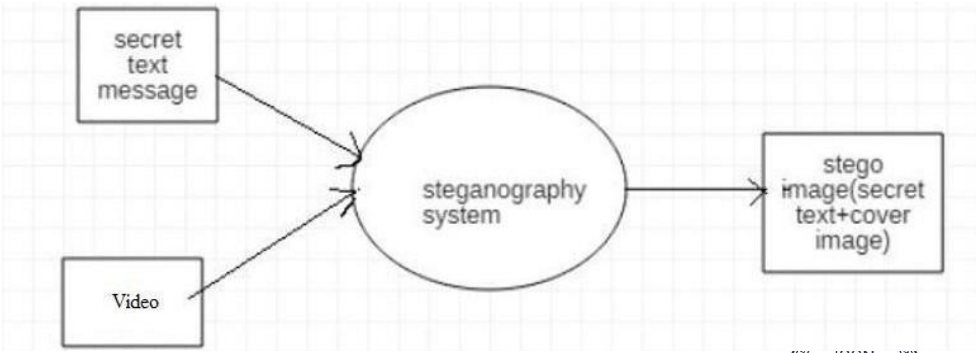


Figure: 4 Class Diagram

4.2 Data Flow Diagram:



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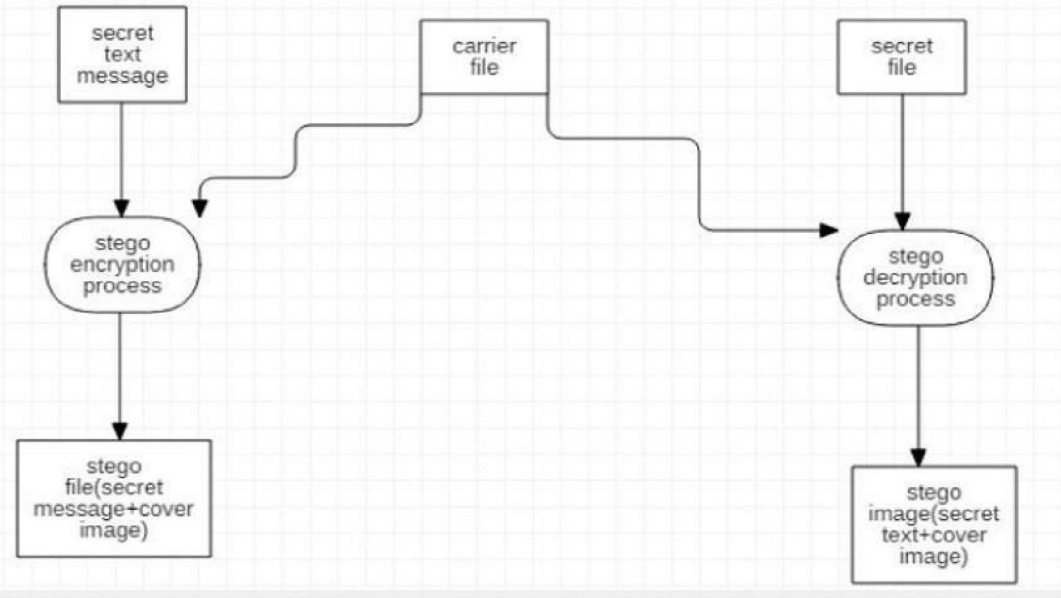

Figure: 5 DATA FLOW Diagram

A dataflow diagram could be a device for alluding to information movement from one module to the following module as appeared in Figure 5. This chart gives the information of each module's information. The outline has no control stream and there are no circles at the same time.

4.3 Use Case Diagram:

A Utilize Case Chart could be a parcel of circumstances that reflect a client-frame relationship. A utilize case chart appears the entertainer-to-use relationship. Utilization cases and on-screen characters are the two primary components of a utilization case chart. An on-screen character alludes to a client or other individual associated with the illustrated handle. A utilize case chart in figure 6 is an out of - the-box viewpoint that talks to a few action each module will perform to total an errand

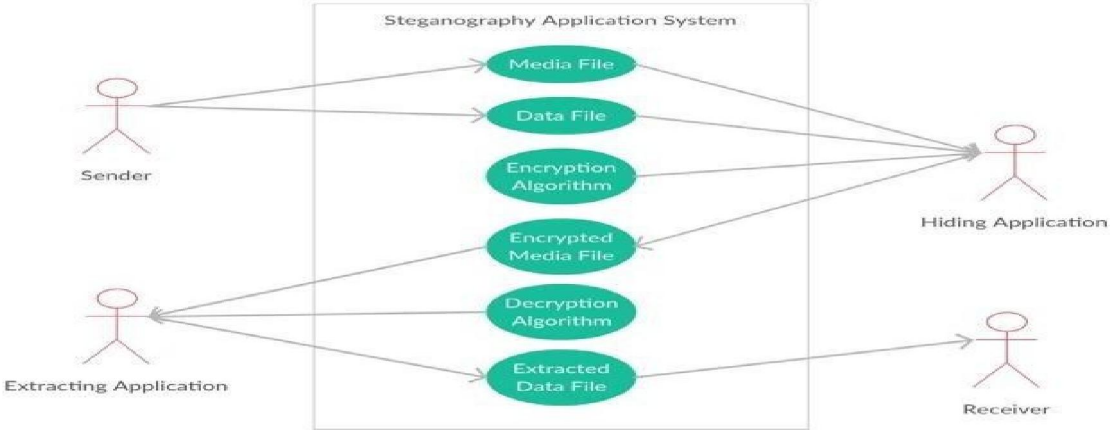

Figure 6. Use case diagram

4.4 System Implementation

In this area, we proposed an calculation which comprises of irregular choice of outlines, LSB strategy, and resizing an picture file. The engineering is appeared within the figure downwards. As already, we moreover know video steganography can be done by sound or picture steganography strategy, here we select picture steganography rationale

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to actualize video steganography. Here we take the video-path and the covering up picture path as the input additionally the key of the covered up strategy strategy must be inputted.

Bit-Slicing: In this segment, the data, ought to be covered up is taken for handling. This prepare incorporates picture bit cutting and division of that picture into 8 different bit- planes. The pixel values of each picture are changed over to its comparing 8-bit double values. Each ith bit is taken from each byte of pixel

A. Hardware Design

Circuit Diagram

The power circuit is intended to supply electricity to the microcontroller and Hall effect current sensor (ACS712 sensor). Both of this equipment require DC power to operate, with the microcontroller powered by a 9V DC supply and the Hall effect current sensor powered by a 5V DC supply supplied bythe microcontroller. As a result, power electronic devices were employed to power these units. The 230V is supplied through power circuit wires installed throughout a house to power various pieces of equipment. A shunt wire is connected to a step-down transformer, which reduces the voltage from 230V AC to 5V AC. The transformation ratio is defined as follows:

$$V\,1/V\,2 = N1/N2 \quad (1)$$

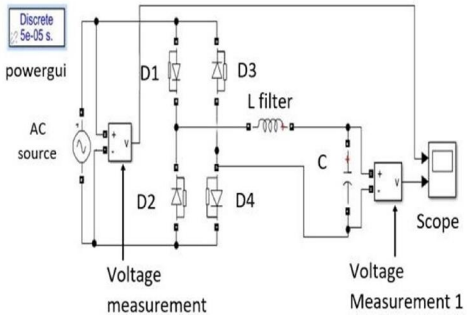

Fig 3: Rectifier Simulation Using MATLAB Simulink

The stepped down voltage of 5V AC is then supplied to a single-phase diode rectifier as shown in Fig. 2which gives an output voltage of 4.58 Volts as given below: For the rectifier:

$$V\,0\,i\,n = 5V\ AC,\ V\,0\ out = 4.58V \quad (2)$$

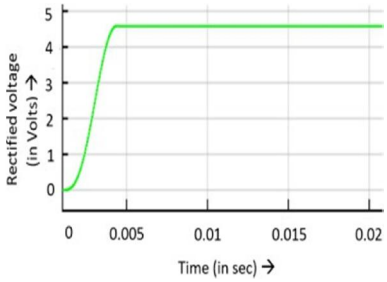

Fig 4: Rectifier Output Voltage Plot with Time

This 4.58V DC output voltage is then sent into the Boost converter as input voltage (Vin),which amplifies the voltage to produce a regulated output voltage (Vo) of 8.98V DC. The boost converter functions as a voltage regulator, producing a constant dc output. Furthermore, the converter operates in continuous conduction mode (CCM). MATLAB Simulink is used to model the operation of the Boost converter. The following formulae are used to create the boost converter:

Maximum Duty Cycle (D):

$D = 1 - (Vin * \eta)/Vo$ (3)Output current (Io):

$Io = (Output\ power)/Vo$ (4)Inductor ripple current (IL):

$IL = (0.2\ to\ 0.4) * Io * Vo/Vin$ (5)Inductance (L):

$L = Vin * D/(fs * IL)$ (6)

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(Here fs= switching frequency i.e., 20kHz) o/p Capacitance (Cout):

$$Cout = (Io * D)/(fs * Vo(ESR)) \quad (7)$$

(Here Vo (ESR) is the additional o/p voltage ripple due to equivalent series resistance of o/p capacitor)

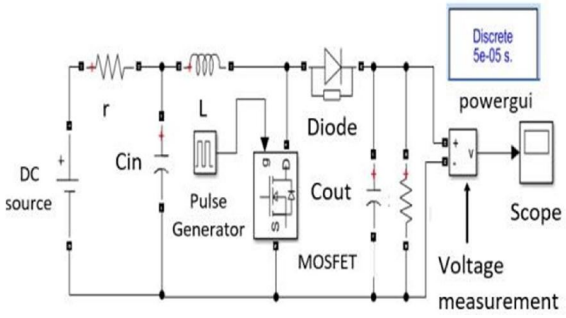

Fig 5: Boost Converter Simulation Using MATLAb Simulink

Current sensing using Hall Effect Sensors

The hall effect sensor is used to detect the system's input current. This device is linked in series with the power supply of the device where sensing will take place. It is powered by a 5V DC source (Vcc). The output pins are Vcc, ground, and analogue input. The analogue input is linked to the microcontroller's analogue pins.

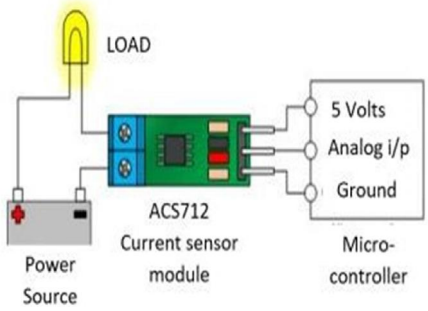

Fig 6 Circuit Diagram of Current Sensor with Microcontroller Unit

The microcontroller is powered via the Boost converter's output terminals. When no AC input is available, this sensor outputs a bias voltage of 2.5V DC, indicating that no AC current is flowing in the system.

Data Transfer and Receiver unit

The data transfer process is facilitated by an Arduino UNO microcontroller and a Wi-Fi module working in conjunction. The Wi-Fi module (ESP8266) with Vcc = 3.3V is attached to the Arduino controller for data transmission and reception. The data is logged into the system, i.e., the perceived current from the current sensor is transferred to the cloud storage through the Wi-Fi module's transmitter unit. The receiver is positioned 10 metres away at the opposite end, and the data is instantly entered into the cloud database. Thislogging is conducted every two minutes from the start of system operation, and the system will change the rate of data logging to other time intervals based on the data obtained. This change is based on the type of device connected to the system, and it is communicated to the firebase cloud. This data is then analysed, and a projected electricity cost for the system is computed.

B. Software Design

Software Workflow

The Software component is divided into two sections. One is the user interface, while the other is the application's backend. An Android application was used to construct the user interface for tracking the progress of power bills. Django is used to write the backend. Android Studio is a software application for creating user interfaces built in

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the Java 8 Standard Edition language and XML. Python is used as a coding language for the backend. Furthermore, the Firebase cloud is utilised to store the data, which serves as a database for recording data. Another application-level database, sqlite, is utilised to store a specific user's session. The Wi-Fi module receives current (in Amperes), which is entered in the database along with the relevant socket information. Data may be monitored in real time using an Android application. The user inputs the total number of sockets in use as well as the desired bill amount limit (in INR) for which the user wants to be alerted. The backend divides the many sockets into use groups (for example all electric chargers are kept in one cluster, all daily usage devices such as refrigerator, microwave, are kept in another cluster and so on).

This allows the system to recommend better methods to use various gadgets while keeping the intendedquantity in mind. During this process, the system also adjusts itself to aid in the delivery of effective power consumption to the customer. Another approach, forecasting, is utilised to give extra elements for projecting the upcoming month's power expenditure

Sequence Diagram of System Workflow

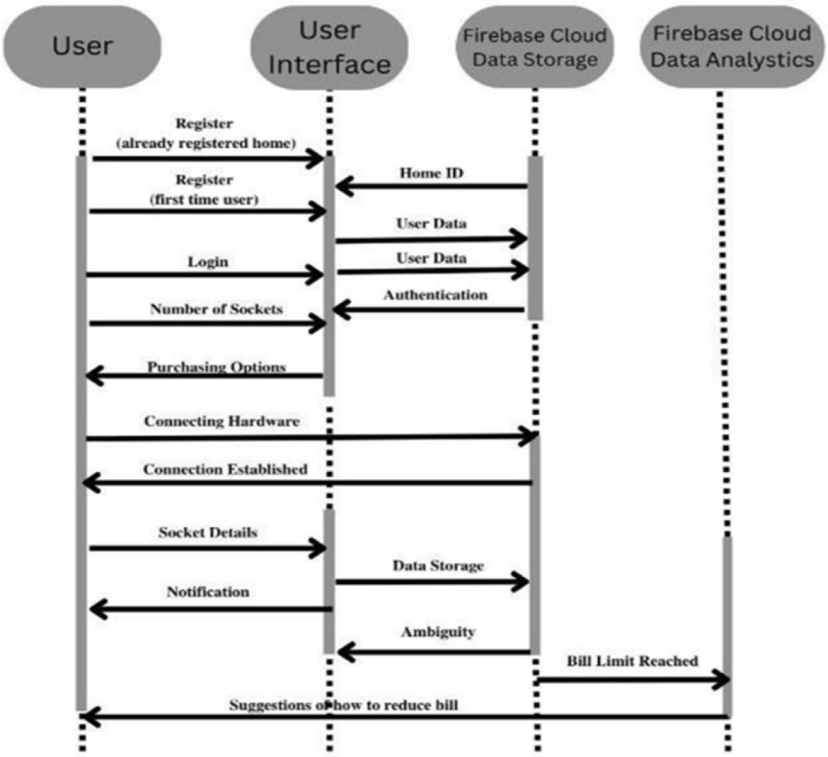

Fig 7: Sequence Diagram of System Workflow

Software User Interface Implementation

The software programme is divided into two modules: user and admin. End users can access the application's user module, whereas the admin module is utilised for KYC verification of end users.

Following are the steps to be followed:

1. To ensure that a single residence is not registered more than once, the user must register via our programme. Following registration, KYC papers must be presented, which must be authorised by the administrator before the user may use the application.
2. Following approval, the user must input the number of plugs in the residence. The consumer will be given the opportunity to purchase the physical gadget. Users must sync hardware devices with our programme using the code provided in the hardware device.

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3. The user is returned to the main screen, where the current status of the bill is displayed. The current status contains the number of days for which the bill is computed, the total number ofunits, and the total money paid thus far. If a person switches from one device to another in a certain socket, the programme provides a message about adding a new device that is plugged in based on changes in perceived current and power used over time. In a real-time cloud database, thedata is saved in a distinct column.
4. Users may add, update, or remove devices from the application at any moment. Through our application, they may monitor their energy bill, verify expected bills, and optimise their electrical bill spending

V. RESULTS

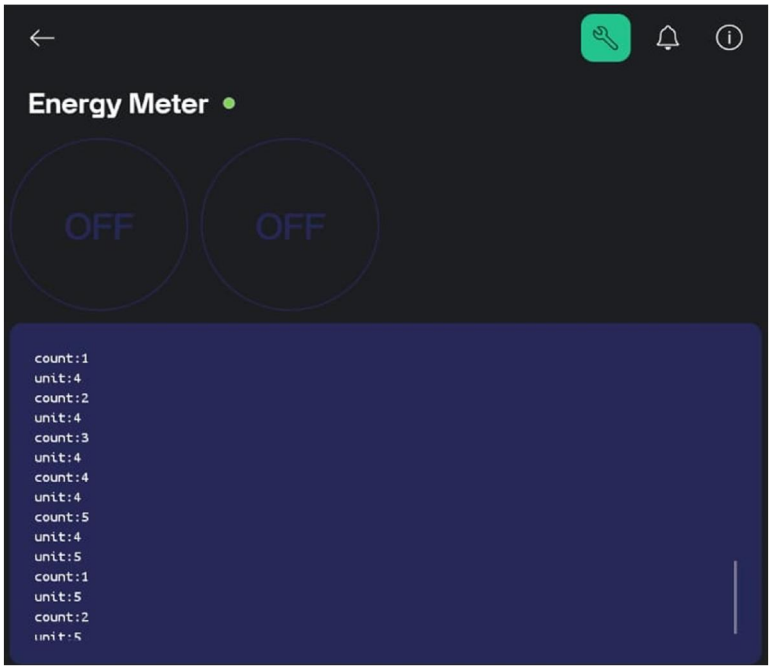

Fig 8 and 9:Data from Monitoring Meter

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Smart electricity meter monitoring and prediction involve using advanced metering infrastructure to continuously collect and analyze electricity usage data. By monitoring energy consumption in real-time, these systems provide detailed insights into usage patterns, enabling consumers to optimize their energy use and reduce costs. Predictive algorithms leverage historical data and machine learning to forecast future consumption, which helps utility companies manage supply and demand more efficiently, preventing outages and reducing energy waste. Additionally, these systems facilitate the integration of renewable energy sources by predicting periods of high or low production, contributing to a more resilient and sustainable energy grid.

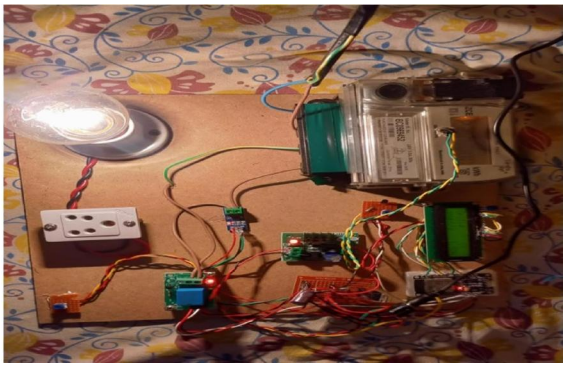

Fig 10: Hardware model

VI. CONCLUSION

Smart electricity meter monitoring and prediction represent a transformative advancement in energy management, offering significant benefits to consumers, utility providers, and the broader energy ecosystem. By leveraging real-time data and sophisticated predictive algorithms, these systems enable precise monitoring of electricity usage and accurate forecasting of future consumption patterns. This real- time insight empowers consumers to optimize their energy usage, reduce costs, and participate in demand- response programs, while utility companies can enhance grid reliability, prevent outages, and manage supply and demand more efficiently. Moreover, the integration of renewable energy sources becomes more seamless, contributing to a more resilient and sustainable energy grid.

Looking ahead, the scope for smart electricity meter monitoring and prediction is expansive, with ongoing technological advancements promising even greater efficiency and effectiveness. Enhanced data analytics, AI integration, and IoT connectivity will further refine predictive capabilities and enable more granular control over energy consumption. As smart grids become more widespread and regulatory support increases, the deployment of smart meters will accelerate globally, including in developing regions. These advancements will not only drive energy efficiency and sustainability but also foster consumer engagement and awareness, ultimately contributing to a more sustainable and environmentally responsible future.

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