DIGITAL ADVERTISEMENT ON CAR

REAR SCREEN

BSEE-FALL-(2019)

Submitted by

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Certification

This is to certify that **[Habib ur rehman]**, **[007]** , **[Talha whaid]**, **[036] and [Mohsin Quddos],[015]** have successfully completed the final project **[DIGITAL ADVERTISEMENT ON CAR REAR SCREEN],** at the **[Foundation University]**, to fulfill the partial requirement of the degree **[Bachelor of Sciences in Electrical Engineering].**

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DIGITAL ADVERTISEMENT ON CAR REAR SCREEN

Sustainable Development Goals

SDG No	Description of SDG	SDG No	Description of SDG
SDG 1	No Poverty	SDG 9	Industry, Innovation, and Infrastructure
SDG 2	Zero Hunger	SDG 10	Reduced Inequalities
SDG 3	Good Health and Well Being	SDG 11	Sustainable Cities and Communities
SDG 4	Quality Education	SDG 12	Responsible Consumption and Production
SDG 5	Gender Equality	SDG 13	Climate Change
SDG 6	Clean Water and Sanitation	SDG 14	Life Below Water
SDG 7	Affordable and Clean Energy	SDG 15	Life on Land
SDG 8	Decent Work and Economic Growth	SDG 16	Peace, Justice and Strong Institutions
		SDG 17	Partnerships for the Goals

Sustainable Development Goals:

SDG 8: Decent Work and Economic Growth
SDG 9: Industry, Innovation, and Infrastructure
SDG 11: Sustainable Cities and Communities
SDG 12: Responsible Consumption and Production
SDG 13: Climate Action
SDG 17: Partnerships for the Goals

Range of Complex Problem Solving

	Attribute	Complex Problem	
1	Range of conflicting requirements	Involve wide-ranging or conflicting technical, engineering and other issues.	
2	Depth of analysis required	Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models.	
3	Depth of knowledge required	Requires research-based knowledge much of which is at, or informed by, the forefront of the professional discipline and which allows a fundamentals-based, first principles analytical approach.	
4	Familiarity of issues	Involve infrequently encountered issues	
5	Extent of applicable codes	Are outside problems encompassed by standards and codes of practice for professional engineering.	
6	Extent of stakeholder involvement and level of conflicting requirements	Involve diverse groups of stakeholders with widely varying needs.	
7	Consequences	Have significant consequences in a range of contexts.	
8	Interdependence	Are high level problems including many component parts or sub-problems	
Range of Complex Problem Activities			
	Attribute	Complex Activities	
1	Range of resources	Involve the use of diverse resources (and for this purpose, resources include people, money, equipment, materials, information and technologies).	
2	Level of interaction	Require resolution of significant problems arising from interactions between wide ranging and conflicting technical, engineering or other issues.	
3	Innovation	Involve creative use of engineering principles and research-based knowledge in novel ways.	
4	Consequences to society and the environment	Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation.	
5	Familiarity	Can extend beyond previous experiences by applying principles-based approaches.	

Undertaking

      I certify that the project **[DIGITAL ADVERTISEMENT ON CAR REAR SCREEN]** is our own work. The work has not, in whole or in part, been presented elsewhere for assessment. Where material has been used from other sources it has been properly acknowledged/ referred.

[Engr Habib ur Rehman]

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[Engr Mohsin Quddos]

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CERTIFICATE

This is to certify that this project report entitled "**DIGITAL ADVERTISEMENT ON CAR REAR SCREEN**" *by* **Habib ur rehman (F19-BSEE 007), Mohsin quddos (F19-BSEE 015),Talha wahid (F19-BSEE 036),** submitted in partial fulfillment of the requirements for final year project during the academic year 2023-XX, is a bonafide record of work carried out under my guidance and supervision.

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STATEMENT OF ORIGINALITY

We namely **Habib ur rehman, Talha wahid & Mohsin quddos**
Submitting final year Project Report Phase-1 titled "**Digital advertisement on car rear screen "**State that I/we clearly understand what plagiarism is and we have also read about it using online sources. As such, I/we claim that this entire work (code, reports etc.) is our own effort. We have not used/copy or pasted or paraphrased even a single line of code or sentence from any other source **without giving a proper reference to it**. Based on our confidence in our originality, we allow the University to run anti-plagiarism software on the report.

We understand that if now, or in the future, ever it is found out that we have not been honest and have plagiarized, the university will take action and will result in disciplinary action, such as the cancellation of our degree and I/we can be liable for any subsequent punishments as deemed appropriate by the University as well as the Higher Education Commission Pakistan.

_____
Habib ur Rehman

_____
Mohsin Quddos

_____
Talha wahid

4. ABSTRACT

As we know advertisement is an important aspect .Advertising used to be simple; there was a time when putting up a sign outside the shop or distributing flyers all around the town were enough. This was perfectly fine during the 17th century. Fast forward to the present, the world is now drifting in the sea of commercial clutter. It takes a great deal of time, planning, and effort in order to face the top advertising problems of today.To give your business a voice you have to advertise it to public because advertisement can drive business growth. Advertising is of utmost importance in today's business world. It creates awareness, builds brand reputation, drives sales, and stimulates economic growth. By reaching a wide audience through various channels, advertising introduces products or services, establishes trust, and encourages consumer action. Advertising works to amplify your business marketing efforts and helps you reach the right audience with positive, targeted messaging that converts potential customers into paying customers. It also helps you re target your audience, whether you're aiming to build brand awareness or drive returning business from loyal customers.

In this Project we applied a unique idea for marketing and advertising your buisness. We offered a running ads on the rear screen of the cars of an ordinary citizens and this is not only for marketing or advertising purpose it is also a part time job .

The main objective of this project is to establish a network of connected cars, controlled by a centralized web server, to manage and distribute advertisement projections. By utilizing the rear screens of vehicles as captivating displays, this system offers a unique platform for advertisers to showcase their content while providing an opportunity for car owners to earn income. And it is a part time job for the users.

In this system we make a server based technology that connects the user with the company by mean of a mobile App and a Projection device. A person who installs the device in his car he has to register to the company and To enhance the functionality of the system, a mobile application will be developed, allowing users to register with the company. User registration will facilitate personalized experiences and targeted advertising. Additionally, the mobile application will integrate GPS location tracking using a dedicated module, enabling real-time tracking of user locations for effective advertising targeting.The proposed system architecture encompasses several components: the web server, mobile application, projection devices, and user registration system. The web server will serve as the central control center, responsible for managing and distributing advertisement content to the connected cars. It will also handle user registration and earnings calculations based on the user's participation in the advertising program.The mobile application will act as a user interface, enabling advertisers to upload projection videos, controlling the advertising process, and allowing users to register themselves with the company. Registered users will have access to personalized advertisements and the ability to earn income through the display of advertisements on their vehicles' rear screens.

To achieve projection on the rear screen, a specialized device will be developed, equipped with a GPS module for location tracking. This device will receive projection data and GPS coordinates from the mobile application via Bluetooth. The projection device will display the advertisement content on the car's rear screen while also transmitting the live location coordinates to the server for targeted advertising and earnings calculation.

By implementing this innovative car advertisement system, numerous benefits can be realized. Advertisers gain access to a unique and captivating advertising medium, increasing the visibility and effectiveness of their campaigns. Car owners have the opportunity to monetize their vehicles by participating in the advertising program, earning income through

the display of targeted advertisements. Users can enjoy personalized advertisements and potentially earn income by registering with the company.

The proposed system offers scalability, as the web server can manage a growing network of connected cars and user registrations. The integration of GPS location tracking enhances the system's ability to deliver contextually relevant advertisements, maximizing their impact. Furthermore, user registration and earnings integration create a business model that fosters user engagement and incentivizes participation.

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Chapter 1

Introduction

1.1. <u>Background</u>:

The history of advertising can be traced back thousands of years, with its roots embedded in ancient civilizations. The earliest forms of advertising can be seen in ancient Egypt, where papyrus was used to create posters and sales messages. In ancient Greece, town criers were employed to shout out the benefits of various products and services.

During the Middle Ages, advertising took the form of signs and symbols, often used to identify different trades or businesses. With the invention of the printing press in the 15th century, printed advertisements began to emerge. The growth of newspapers and magazines in the 17th and 18th centuries provided further platforms for advertising, allowing businesses to reach larger audiences.

The industrial revolution in the 19th century brought significant changes to the advertising industry. As mass production and urbanization increased, so did the need for businesses to promote their products and services. Outdoor advertising in the form of billboards, posters, and painted signs became common sights in cities.

The 20th century witnessed substantial advancements in advertising techniques. The rise of radio and television opened up new avenues for reaching consumers. Radio commercials and sponsored programs became popular, followed by television commercials that combined visuals and audio to engage viewers. Advertisers began to understand the power of emotions, storytelling, and catchy jingles to capture audience attention.

The digital age, starting in the late 20th century, marked a profound shift in advertising. With the rise of the internet and digital technologies, new channels for advertising emerged. Online advertising enabled targeted ads based on user behavior and preferences. Social media platforms and search engines played a significant role in this transformation, providing businesses with opportunities to reach specific demographics.

Today, advertising is a dynamic and ever-evolving industry. With the advent of mobile devices and the widespread use of social media, advertisers can engage consumers in personalized and interactive ways. The use of data analytics, artificial intelligence, and influencer marketing has further expanded the possibilities for effective advertising.

Throughout its history, advertising has played a crucial role in driving economic growth and consumer awareness. It has adapted to changes in technology, consumer behavior, and cultural trends, constantly seeking innovative ways to capture attention and convey messages. The advertising industry continues to evolve, embracing new technologies and strategies to reach audiences in an increasingly digital and connected world.

Now a day Advertisment became the most impotant tool of the buisness and lot of platforms are also be availble for advertisment including spreding flyers,billboards , tvs , social media etc.

1.2. **Problems** :

Advertising is very important nowadays. According to research, business owners invest 30% of their business budget in advertising. However, the problem lies in reaching the right audience. Nowadays, it is easy to advertise your product or business, but it is difficult to target the right audience using both old and current advertising methods. For example, let's consider flyers. It is estimated that 30,000 trees are cut down daily for paper production, and we are wasting that paper on advertising. Additionally, printers emit traces of carbon during printing, which has serious environmental side effects, including ozone depletion, asthma, acid rain, and air pollution. Similarly, billboards pose the risk of collapsing during thunderstorms, making them environmentally unfriendly. If we choose to advertise through social media, there are also risks involved. Entrepreneurs often question whether their product has reached the right audience ?

1.3. **Purpose** :

Our project is driven by the desire to serve mankind and contribute to the growth of new entrepreneurs and small business startups. By providing a platform for targeted advertising, we aim to help these businesses reach the right audience and promote their projects effectively. Additionally, our project creates job opportunities for middle-class individuals, such as car owners or taxi drivers, allowing them to earn a decent income without engaging in physically demanding work.

An important aspect of our project is its commitment to environmental sustainability. Unlike traditional advertising methods, our approach is entirely eco-friendly, minimizing the negative impact on the environment. By utilizing the rear screen of cars for advertising projections, we

avoid the excessive use of paper, plastics, or other materials that contribute to waste and pollution.

By promoting a greener and pollution-free world, our project aligns with the larger goal of creating a positive impact on society. We aim to revolutionize the advertising industry by providing a solution that benefits both businesses and individuals while minimizing environmental harm. It is a step towards a more sustainable future, where technological advancements can be harnessed for the betterment of society and the planet.

our project serves as a catalyst for the growth of small businesses, provides income opportunities for individuals, and contributes to a cleaner and greener world. Through our innovative and environmentally friendly approach to advertising, we strive to make a positive difference in society and support the development of a sustainable economy.

1.4. **<u>Overview</u>** :

In order to address the inherent challenges and inefficiencies associated with conventional methods of advertising, we have pioneered an unparalleled and cutting-edge approach that revolutionizes the way advertisements are delivered. Our innovative solution entails projecting captivating and visually engaging ads directly onto the rear screen of automobiles, thereby presenting an entirely novel and progressive medium for promotional campaigns. Our project stands out as a pinnacle of uniqueness and moderation within the realm of advertising, offering an unparalleled level of environmental friendliness while simultaneously exerting a profoundly positive impact on the community at large.

This visionary undertaking encompasses a multitude of intricately designed components and accessories, each serving a specific purpose and contributing to the seamless operation of our groundbreaking advertising system. To initiate this extraordinary endeavor, we embark on the development of a sophisticated and user-friendly mobile application that seamlessly connects users with the robust capabilities of the Raspberry Pi microcomputer. Leveraging the power of Bluetooth technology, our state-of-the-art application facilitates seamless data transfer and communication between users, thereby establishing a cohesive and interconnected network that propels the dissemination of advertisements.

Within the realm of Raspberry Pi integration, we integrate a highly precise and cutting-edge GPS sensor, enabling real-time location tracking and positioning of users. The invaluable data captured by the GPS sensor is transmitted through the Bluetooth module, facilitating instantaneous communication with the central server responsible for controlling and managing all advertisements. Through an intricate and meticulously crafted algorithm, our server dynamically tailors and customizes the display of advertisements based on the precise geographic location of users, ensuring the delivery of targeted and location-specific promotional content. The HDMI port of the Raspberry Pi serves as the conduit through which the meticulously curated advertisement data is seamlessly transmitted to the projection device, which is strategically positioned on the rear screen of the vehicle.

A robust and sophisticated server infrastructure lies at the heart of our revolutionary advertising system. Leveraging the unparalleled capabilities and real-time functionality of Firebase, our server acts as the authoritative control center, meticulously overseeing every facet of the advertisement ecosystem. Comprehensive data pertaining to advertisement details, including location-specific campaigns and their associated content, are meticulously stored

within the server. Furthermore, the server retains precise records of user earnings, as our system offers users a unique opportunity to generate income through participation in our advertising network. By accurately assessing the cost and value of individual advertisements within specific geographic areas, our server efficiently and fairly compensates users, providing a transparent and reliable means of income generation. Additionally, the server exercises meticulous control and management over the advertisements, dictating precisely which ads are projected in specific regions, thereby ensuring a harmonious and coordinated campaign delivery process.

To achieve the awe-inspiring projection capabilities intrinsic to our system, we employ a state-of-the-art holographic projector. This remarkable device incorporates an array of sophisticated LED fans that, upon activation, undergo a mesmerizing rotation, culminating in the creation of a dynamic and visually captivating screen-like surface. When observed from the rear side of the projector, a transparent view of the surrounding environment is perceptible. However, when viewed from the front, the projector transforms into a vivid and compelling display, seamlessly showcasing the meticulously curated advertisement content. By strategically situating this holographic projector on the rear screen of vehicles, passersby and onlookers outside the car are instantly captivated by the vivid and engaging advertisements, while occupants within the vehicle enjoy an unobstructed view of their surroundings.

The comprehensive and integrated nature of our advertising system ensures the establishment of a cohesive and streamlined ecosystem. To spearhead the successful implementation of our solution, we have strategically partnered with industry-leading companies such as Uber and Careem, capitalizing on their vast network of vehicles and unrivaled reach. These influential partners seamlessly integrate our devices onto the rear screens of their user's vehicles, effectively transforming these automobiles into powerful and dynamic advertising platforms. Through this symbiotic collaboration, our partners leverage our innovative

1.5. <u>Component Used</u> :

1.5.1. <u>Raspberry Pi</u>

The Raspberry Pi 4 Model B with 2GB RAM is a versatile and powerful single-board computer. It is part of the Raspberry Pi series, a line of affordable and credit card-sized computers developed by the Raspberry Pi Foundation. The 2GB variant of the Raspberry Pi 4 offers a balance between performance and cost, making it suitable for a wide range of projects and applications.

Here are some key features and specifications of the Raspberry Pi 4 Model B 2GB:

Processor: The Raspberry Pi 4 is equipped with a quad-core Broadcom BCM2711 processor, running at 1.5 GHz. This processor provides a significant performance boost compared to its predecessors, enabling smooth multitasking and demanding applications.

RAM: With 2GB of LPDDR4 SDRAM, the Raspberry Pi 4 2GB variant offers sufficient memory for most tasks, allowing for smooth execution of applications, web browsing, and light gaming.

Connectivity: The Raspberry Pi 4 features dual-band 2.4 GHz and 5 GHz wireless LAN, as well as Bluetooth 5.0. It also includes Gigabit Ethernet for reliable wired network connections. These connectivity options make it easy to connect to networks, peripherals, and other devices.

Multimedia Capabilities: The Raspberry Pi 4 supports dual-monitor setups with up to 4K resolution via two micro HDMI ports. It also has hardware decoding for smooth playback of high-definition videos. Additionally, it includes a CSI camera port and a DSI display port for connecting compatible cameras and displays.

USB and Expansion: The Raspberry Pi 4 offers two USB 3.0 ports and two USB 2.0 ports, providing ample connectivity for peripherals such as keyboards, mice, external drives, and more. It also has a microSD card slot for storage and an improved USB-C power supply.

Operating System: The Raspberry Pi 4 is compatible with various operating systems, including the official Raspberry Pi OS (formerly Raspbian), Ubuntu, and several Linux distributions. It also supports popular software development platforms and programming languages.

GPIO Pins: Like previous Raspberry Pi models, the Raspberry Pi 4 has a 40-pin GPIO (General Purpose Input/Output) header, allowing for the connection of sensors, actuators, and other electronic components, making it suitable for IoT (Internet of Things) projects.

Overall, the Raspberry Pi 4 Model B 2GB offers a cost-effective and feature-rich computing platform for hobbyists, educators, and professionals alike. Its versatility, expandability, and strong community support make it an excellent choice for various applications, including home automation, robotics, media centers, retro gaming, and learning programming and electronics
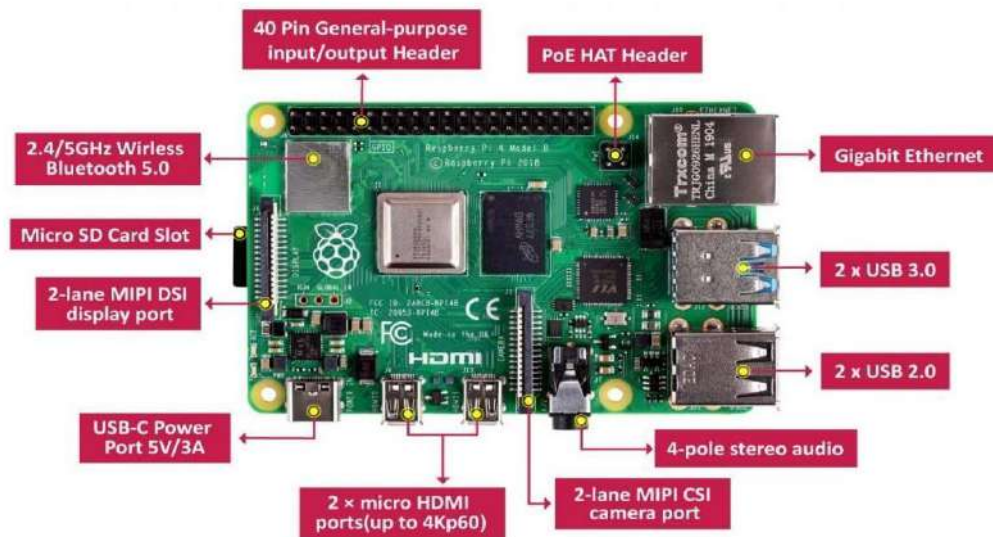

Figure 1.1 Raspberry Pi 4 (2gb)

1.5.2. SD Card 3.0 :

SD Card 3.0 is a type of memory card that offers faster data transfer speeds compared to previous versions. It utilizes the UHS-I (Ultra High-Speed) bus interface, allowing for improved performance when reading and writing data. SD Card 3.0 is backward compatible with older SD card slots but delivers enhanced speed and performance on devices that support it.

Figure 1.2 SD Card (3.0)

Purpose : SD Card 3.0 is commonly used in Raspberry Pi computers to store the operating system, program files, and user data. It provides a portable and expandable storage solution for the Raspberry Pi, allowing users to easily switch between different operating systems and projects. With its improved data transfer speeds, SD Card 3.0 enables faster boot times and smoother performance for the Raspberry Pi. Additionally, its backward compatibility ensures compatibility with older Raspberry Pi models and other devices that support SD cards. Users can conveniently install various operating systems, such as Raspberry Pi OS or other Linux distributions, onto the SD card and experiment with different projects and software. The versatility and speed of SD Card 3.0 make it an essential component for Raspberry Pi enthusiasts and learners.

1.5.3. VGA to HDMI Converter :

A VGA to HDMI converter is a device used to convert analog VGA (Video Graphics Array) signals to digital HDMI (High-Definition Multimedia Interface) signals. VGA is an older video standard commonly found in older computers and displays, while HDMI is a newer standard used for high-definition video and audio transmission.The VGA to HDMI converter acts as an intermediary between devices that use different video standards. It takes the VGA signal from a source, such as a computer or laptop, and converts it into an HDMI signal that can be used with modern displays, projectors, or televisions.The converter typically requires a power source and may have additional input/output ports for audio connection. It ensures compatibility between VGA-based devices and HDMI-based displays, allowing users to enjoy high-quality visuals and audio without needing to upgrade their equipment.

Figure 1.3 VGA to HDMI converter

Purpose : The purpose of a VGA to HDMI converter in a Raspberry Pi setup is to connect the Raspberry Pi to displays or projectors that only support HDMI input. Raspberry Pi boards usually have HDMI output ports, which are compatible with modern high-definition displays. However, some older displays or projectors may only have VGA input ports. By using a VGA to HDMI converter, Raspberry Pi users can bridge the gap between these different video standards and connect their Raspberry Pi to VGA displays. This enables them to utilize a wider range of displays or projectors, expanding the versatility of the Raspberry Pi.The converter ensures that the analog VGA signal from the Raspberry Pi is properly converted into a digital HDMI signal that is compatible with HDMI displays. This allows users to enjoy high-definition video output and, in some cases, transmit audio as well, as HDMI supports both audio and video signals.

Using a VGA to HDMI converter with a Raspberry Pi can be particularly useful in situations where HDMI displays are not readily available, such as in older classrooms, conference rooms, or home entertainment systems that still rely on VGA technology. It allows Raspberry Pi users to repurpose existing VGA-based equipment and extend the usefulness of their Raspberry Pi.s.Moreover, the VGA to HDMI converter simplifies the connection process, eliminating the need for multiple adapters or complicated wiring setups. It provides a straightforward and convenient solution for users who want to connect their Raspberry Pi to VGA displays without compromising on video quality

1.5.4. **Raspberry Pi Charger :**

The Raspberry Pi 4 2 GB charger is a power adapter designed specifically for the Raspberry Pi 4 model with 2 GB of RAM. It is used to provide the necessary electrical power to the Raspberry Pi 4 board so that it can function properly.The charger for the Raspberry Pi 4 2 GB model delivers a stable power supply to ensure smooth operation. It converts the electrical current from a wall outlet or a USB power source into the correct voltage and current required by the Raspberry Pi 4.The Raspberry Pi 4 2 GB charger has a voltage output of 5 volts. This means it provides a consistent electrical potential of 5 volts to the Raspberry Pi 4 board. It is

important to use a charger that delivers this specific voltage, as it is the standard requirement for the Raspberry Pi 4.

In terms of power, the charger for the Raspberry Pi 4 2 GB model should have a minimum output of 3 amps (3000 milliamps). This ensures that the Raspberry Pi 4 receives sufficient power to run all its components smoothly. Using a charger with a lower power output may result in unstable performance or even system crashes.It is crucial to use the correct charger with the Raspberry Pi 4 2 GB model to avoid any potential damage to the board. The recommended charger specifications for the Raspberry Pi 4 2 GB model help ensure the stability and reliability of the system, allowing users to enjoy the full capabilities of their Raspberry Pi 4 board.

Figure 1.4 Pi Charger

1.5.5. <u>HDMI to micro Hdmi Converter</u>

An HDMI to Micro HDMI converter is a special device that helps you connect two different types of ports. HDMI is a common type of port used for video and sound, while Micro HDMI is a smaller version of that port found in some smaller devices like phones or tablets. The converter takes the big HDMI plug and changes it into a smaller Micro HDMI plug so you can connect devices with different ports. It's useful because it lets you connect your regular-sized HDMI devices, like laptops or game consoles, to smaller devices with Micro HDMI ports, like certain cameras or tablets. With the converter, you can enjoy watching videos or playing games on different devices, even if they have different types of ports.

Figure 1.5 Hdmi to micro Hdmi converter

Purpose : A Micro HDMI to HDMI converter is used with a Raspberry Pi to connect it to devices that have a regular-sized HDMI input. The Raspberry Pi has a smaller Micro HDMI output port, while most displays, TVs, and monitors have regular HDMI input ports.

The purpose of using the converter is to bridge the gap between these different port sizes and allow the Raspberry Pi to be connected to devices with regular HDMI inputs. This enables users to utilize a wider range of displays and enjoy high-quality video output.The converter ensures that the Micro HDMI signal from the Raspberry Pi is converted into the regular HDMI format, making it compatible with devices that have HDMI inputs. This allows users to connect their Raspberry Pi to larger screens, such as TVs or computer monitors, and experience their projects on a bigger display.

Using a Micro HDMI to HDMI converter with a Raspberry Pi is particularly beneficial when working on projects that require a larger viewing area or when using the Raspberry Pi for multimedia purposes. It provides flexibility in display options and allows users to take advantage of higher resolutions and better visual quality.Additionally, the converter simplifies the connection process by eliminating the need for additional adapters or complex configurations. It provides a straightforward solution for connecting the Raspberry Pi to devices with regular HDMI inputs, making it more accessible to users of all skill levels.

1.5.6. <u>Video display using raspberrypi:</u>

Connecting a projector to a Raspberry Pi using the mini HDMI port is a straightforward process. The Raspberry Pi features a mini HDMI port, which allows you to transmit audio and video signals to an external display device like a projector. To establish the connection, you will need a mini HDMI to HDMI cable. One end of the cable plugs into the mini HDMI port on the Raspberry Pi, and the other end connects to the HDMI input on the projector. Once the connection is made, you may need to adjust the input source on the projector to HDMI. The Raspberry Pi will then transmit its display output to the projector, enabling you to project the content onto a larger screen. This connection is useful for various applications, such as presentations, multimedia playback, or creating a home theater setup using the Raspberry Pi and a projector.

Figure 1.6 GPS module neo 6mv2

1.5.7. <u>GPs module :</u>

The GPS NEO-6M module is a widely used and compact GPS (Global Positioning System) module manufactured by U-blox. It is designed to provide accurate positioning and timing information in a small form factor. The NEO-6M module integrates a GPS receiver capable of acquiring signals from multiple GPS satellites orbiting the Earth. It processes these signals to determine its precise latitude, longitude, and altitude coordinates, enabling accurate positioning on the Earth's surface. The module also synchronizes its internal clock with the highly accurate atomic clocks on the GPS satellites, allowing it to provide precise time information. The NEO-6M module communicates with external devices using a serial communication interface, typically UART, and transmits data in the standardized NMEA (National Marine Electronics Association) format. It supports various NMEA sentences, including GGA, RMC, and VTG, which provide essential positioning, navigation, and speed information. The NEO-6M module is known for its ease of integration, low power consumption, and compatibility with different microcontrollers and development boards, making it a popular choice for GPS-enabled applications such as navigation systems, tracking devices, and unmanned aerial vehicles (drones).

working:
GPS (Global Positioning System) is a satellite-based navigation system that enables precise positioning and timing information worldwide. It consists of a network of orbiting satellites, ground control stations, and GPS receivers. The satellites continuously transmit signals that contain information about their location and time. A GPS receiver receives signals from multiple satellites and uses the time delay between signal transmission and reception to calculate the distance to each satellite. By triangulating the distances from at least four satellites, the GPS receiver can determine its precise position on the Earth's surface through a process called trilateration. The receiver also synchronizes its internal clock with the atomic clocks on the satellites, allowing it to provide accurate time information. GPS technology has become ubiquitous and is used in various applications, including navigation systems, mapping, surveying, vehicle tracking, and outdoor recreation.

Output:
The GPS module NEO-6M provides several outputs that convey essential information related to positioning and time. The primary output of the NEO-6M module is the GPS coordinates, which include latitude and longitude values. These coordinates represent the precise location on the Earth's surface where the module is positioned. The latitude indicates the module's north-south position, while the longitude represents its east-west position.

In addition to coordinates, the NEO-6M module also outputs altitude information. This data refers to the module's height above or below a reference point, typically sea level. Altitude can be crucial in applications such as aviation or surveying where vertical positioning is significant.

Furthermore, the module provides accurate time information. It synchronizes with the atomic clocks on GPS satellites, enabling it to offer highly precise timekeeping. The time output from

the NEO-6M module adheres to standard time formats, allowing synchronization with other systems or devices.

Reading of coordinates:

Reading coordinates involves interpreting latitude and longitude values to determine a specific location on the Earth's surface. Coordinates can be represented in decimal degrees (DD) or degrees, minutes, and seconds (DMS) format. In DD format, latitude ranges from -90 to +90 degrees, with positive values indicating locations north of the equator and negative values indicating locations south of the equator. Longitude ranges from -180 to +180 degrees, with positive values indicating locations east of the prime meridian and negative values indicating locations west of the prime meridian. In DMS format, coordinates are broken down into degrees (°), minutes ('), and seconds ("). Degrees represent whole degrees, minutes denote a portion of a degree, and seconds further divide the minutes. By understanding the format and values, one can accurately read and interpret latitude and longitude coordinates to pinpoint a specific location on the Earth's surface for navigation, mapping, or other purposes.

Figure 1.7 GPS module neo 6mv2

1.6. Software Used

1.6.1. Mit App inventor :
For making a mobile application we are using a software known as the MIT app inventor .it is a web aplication integrated enviroment it allow usets to develop app for two operating system android and ios . mit uses a grraphical user interface which is identical to programing language.mit app inventor makes the app development more easy and convinientit had a totally editable database and has a a lot of inbuilt function and layouts. MIT app inventor supports block coding it has a inbuilt connectivity platforms and has also a several sensors data reading blocks available which include temperature humidity etc.it helps to create high impact app in signficantly less time it empower people toward software it is a very great platform for bigners to construct their app .It is used for making the mobile applications according to your

need.The coding which is used for using this software is block based coding in this you have to arrange the blocks according to your requirement and make your desired app. These blocks have built in back end Java programming you just have to arrange and relate them and take your output. So,in this way this software will help us in making the mobile application

1.6.2.   **Pycharm :**

PyCharm is an IDE created with a focus on Python programming. It is designed to provide developers with a comprehensive and user-friendly environment for their Python projects. It is a special computer program that helps people write Python code. It's like a tool that makes programming in Python easier and more efficient. PyCharm has many useful features that can be helpful for beginners as well as experienced programmers. It has a friendly and easy-to-use interface that makes it simple to write and edit Python code. PyCharm also has a feature called "code completion" which suggests possible words or commands as you type, saving you time and effort. It can also help you find and fix mistakes in your code by highlighting errors and giving you suggestions on how to correct them.

One of the great things about PyCharm is that it supports many Python libraries. These libraries are like special collections of code that have been written by other people and can be used to do different tasks. For example, there are libraries for doing calculations with numbers, working with data, creating websites, and much more. PyCharm makes it easy to use these libraries in your own projects. It helps you find the right libraries, provides helpful information about how to use them, and even suggests code snippets that you can use as a starting point.

PyCharm is especially useful for web development. It supports popular web frameworks like Django and Flask, which are like sets of tools and rules that make it easier to create websites. With PyCharm, you can create new web projects using these frameworks and it will set up everything you need to get started. It provides templates for creating different parts of a website, helps you with organizing your code, and even has a built-in web server to preview your website while you're working on it
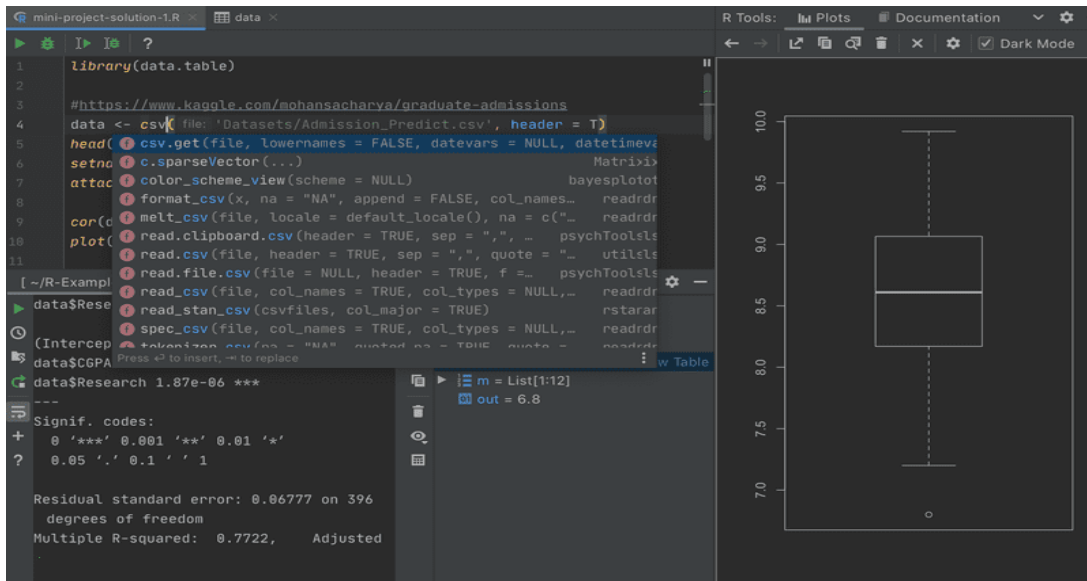
Figure 1.8 Pycharm

1.6.3. Raspberry pi OS

 Raspberry Pi OS is an operating system specifically developed for the Raspberry Pi computer. It is a specialized software that enables the Raspberry Pi to function and perform various tasks. The Raspberry Pi itself is a small and affordable computer that has gained popularity worldwide for its versatility and educational value.Raspberry Pi OS provides a user-friendly interface that allows you to interact with the Raspberry Pi using a monitor, keyboard, and mouse. It is designed to be accessible and easy to use, making it suitable for beginners and enthusiasts alike. With its intuitive interface, you can navigate through different applications and perform tasks with relative ease.

One of the notable features of Raspberry Pi OS is its pre-installed software. It comes with a collection of programs and tools that cater to a wide range of interests and needs. For example, you can browse the internet using the Chromium web browser, create documents and spreadsheets with LibreOffice, play games, listen to music, and watch videos. This makes the Raspberry Pi a versatile and multifunctional device for everyday use.In addition to the pre-installed software, Raspberry Pi OS supports a vast array of applications and software available for installation. This allows you to extend the capabilities of your Raspberry Pi and tailor it to your specific requirements. You can explore and install various software packages to transform your Raspberry Pi into a media center, home automation hub, weather station, robotics controller, or even a retro gaming console. The possibilities are virtually endless, limited only by your imagination and creativity.

Raspberry Pi OS also provides robust support for programming. It is particularly well-suited for learning and practicing programming skills, making it a popular choice among students and educators. The Raspberry Pi supports multiple programming languages, with Python being one of the most commonly used languages. Python is known for its beginner-friendly syntax and versatility, making it an ideal language for those new to programming. With Raspberry Pi OS, you can write and run Python programs, explore electronics projects, and learn about coding concepts in a hands-on manner.Furthermore, Raspberry Pi OS benefits from continuous updates and improvements by its dedicated development team. These updates ensure that the operating system remains secure, stable, and compatible with the latest software advancements. The Raspberry Pi community, comprising enthusiasts and developers worldwide, actively contributes to the ongoing development and support of Raspberry Pi OS. This vibrant community provides valuable resources, documentation, forums, and tutorials that can assist users in troubleshooting, sharing projects, and exploring new possibilities.

Raspberry Pi OS can be easily installed on a microSD card and booted up on the Raspberry Pi. This flexibility allows you to switch between different operating systems or experiment with different versions of Raspberry Pi OS depending on your requirements. The ability to customize and experiment with different setups is a hallmark of the Raspberry Pi ecosystem.
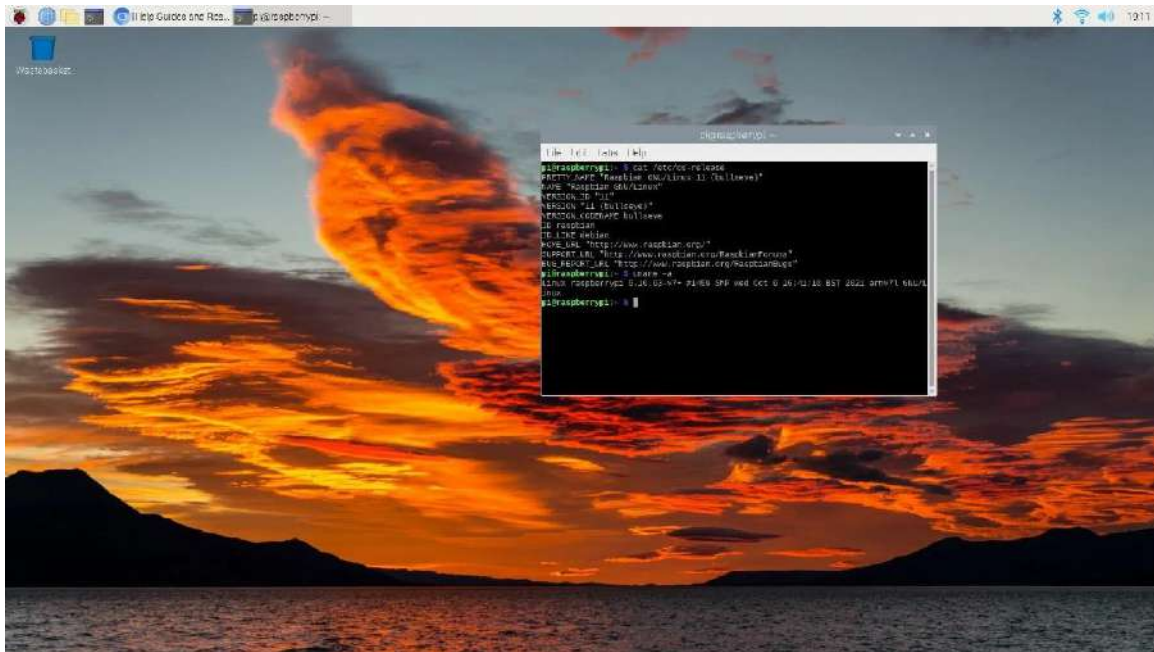

Figure 1.9 raspberry pi OS

Chapter 2

Literature Review

2. Background knowledge:

we have good knowledge of the raspberry pi we have developed a strong understanding of Raspberry Pi and its diverse capabilities. Through our extensive experience, we have become proficient in utilizing the HDMI port for video projection, enabling us to create captivating multimedia applications. Additionally, we have successful ly integrated GPS modules, harnessing their potential to incorporate precise location-based functionalities into our projects.

In the realm of mobile app development, we excel in utilizing MIT App Inventor. This user-friendly platform empowers us to design and develop Android applications using a visual programming interface. It allows us to bring our app ideas to life quickly and efficiently, without the need for complex coding.

Furthermore, we possess a comprehensive knowledge of Firebase, a powerful real-time web server. Leveraging Firebase, we can actively monitor and manage data in real-time, ensuring that our applications remain constantly updated and synchronized across multiple devices. This dynamic feature adds a significant level of responsiveness to our projects.

Overall, our expertise in Raspberry Pi, HDMI video projection, GPS integration, mobile app development with MIT App Inventor, and proficiency in utilizing Firebase for real-time data monitoring position us as a capable team to undertake a wide range of exciting projects. It enables us to explore new avenues in the ever-evolving world of technology.

2.1. Previous working:

In 2019, a company based in Lahore named Screen It worked on a project that aimed to enhance the functionality of car rear screens. They implemented LCD screens on the back of cars, but unfortunately, their approach had some limitations. One major drawback was the lack of user control. The LCD screens were primarily utilized for displaying advertisements, which posed a significant safety concern as they obstructed the driver's rear view.

However, building upon their work, you propose an improved solution. In your project, you plan to give users complete control over the rear screen through a dedicated mobile app. This app will empower users to turn the projection on and off according to their preferences. Additionally, it will provide users with detailed information on earnings, possibly referring to a monetization feature associated with the projected advertisements.

While Screen It didn't implement targeted advertisements, your project aims to introduce targeted advertising by leveraging the capabilities of GPS technology. By utilizing the GPS module, your system will fetch the live location of the user's vehicle. This data can be used to display location-specific advertisements on the rear screen, enhancing the relevance and effectiveness of the advertisements.

To address the safety concerns raised by Screen It's approach, you propose incorporating a holographic projector for the transparent rear view. This holographic projector will project information and images onto one side while maintaining transparency on the other side. This

innovative approach will allow drivers to have a clear and unobstructed rear view, ensuring their safety while still benefiting from the additional functionality provided by the rear screen. Overall, your project seeks to improve upon the previous work by addressing the limitations of the LCD-based approach and introducing user control, targeted advertising, and a transparent rear view through the implementation of a holographic projector.[1]

2.2.<u>FireBase</u> :

Firebase is a mobile platform created by Google that helps developers build high-quality apps more efficiently. It has become an advanced app-development platform on Google Cloud Platform. One of its key features is the Realtime Database, which is a fast and reliable solution for mobile apps that need to synchronize data in real time across different devices. With Firebase, developers can create Android, iOS, and web apps without having to write server-side code.

Firebase offers various tools and services, including analytics tracking, product experiments, marketing features, and crash reporting tools. Its main services include hosting, which allows developers to deploy their apps, and user authentication, which helps manage user logins and security.

The Realtime Database provided by Firebase is especially useful for developing apps that require real-time data updates, such as live streaming or chat messaging. It allows data to be exchanged quickly between devices without needing to refresh the screen. Firebase applications can be deployed securely to the Firebase server, and developers can easily manage their app through a simple control dashboard. Overall, Firebase has many advantages for app developers, making it easier to create powerful and responsive apps. Its real-time data synchronization, simplified development process, and range of tools contribute to its popularity among developers.[2]
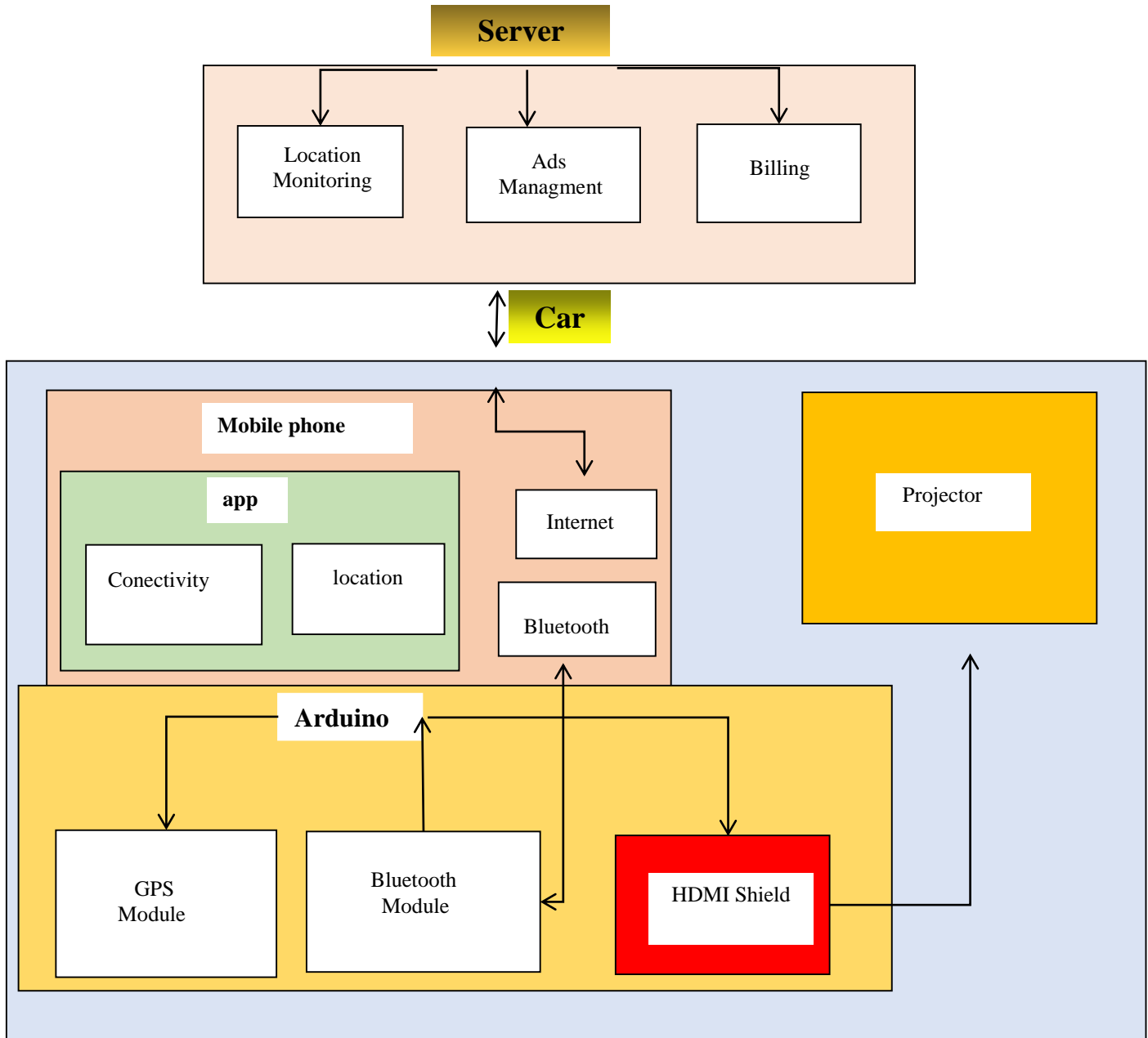
2.3.

3. Chapter 3

Methodology

3. Block Diagram:

3.1.1. <u>Proposed Model</u> :

Server

Location Monitoring	Ads Managment	Billing

Car

Mobile phone

app

Conectivity	location

Internet

Bluetooth

Projector

Arduino

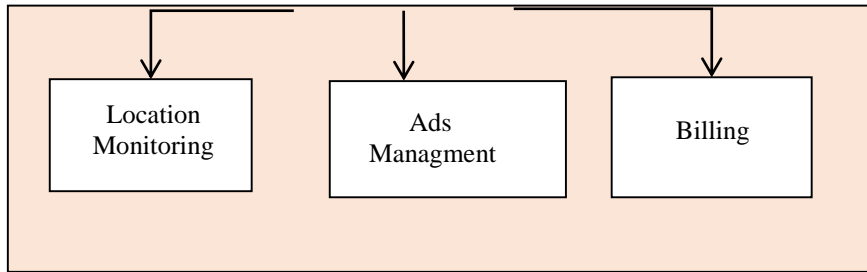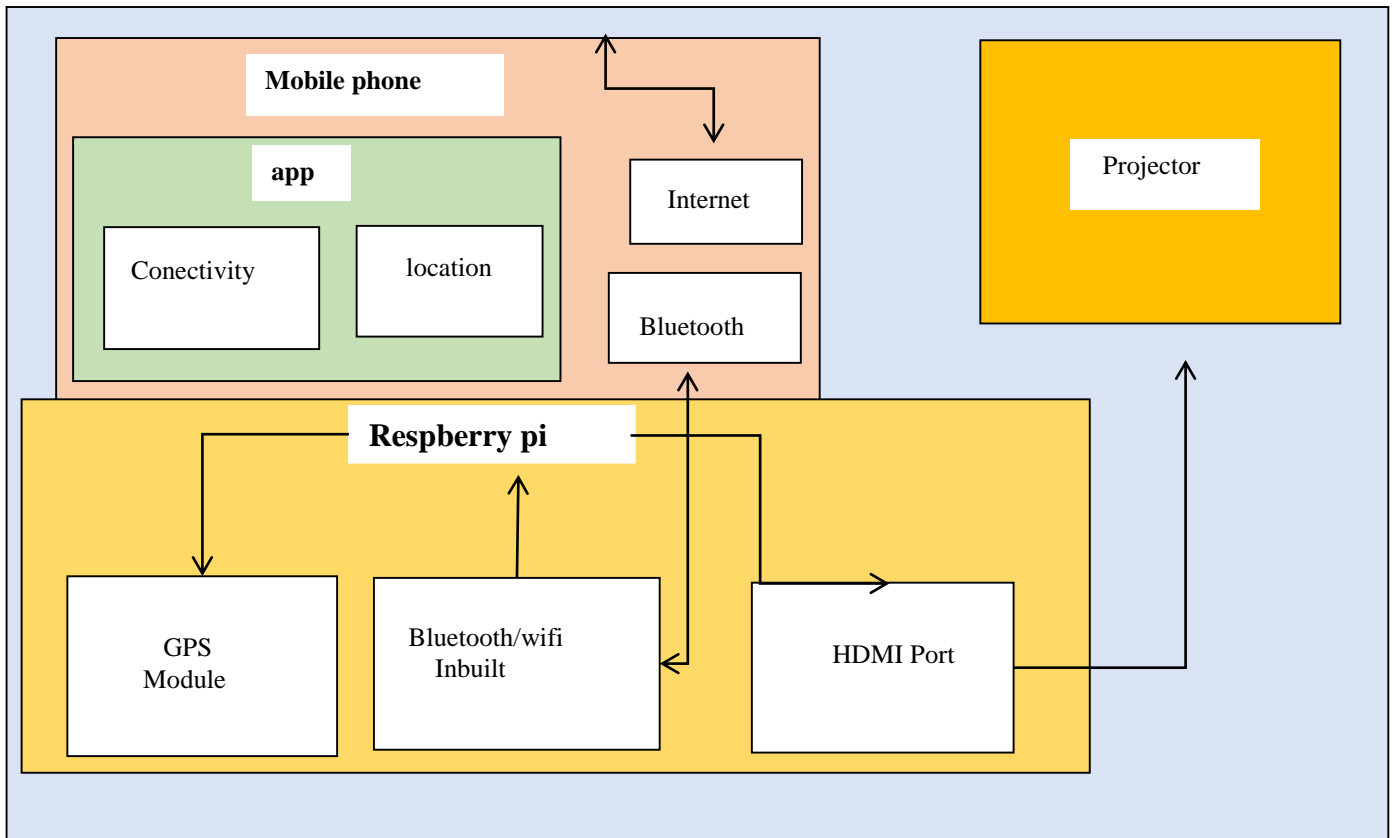| GPS Module	Bluetooth Module	HDMI Shield

3.1.1.2. Drawbacks

1. In Pakistan, the HDMI shield, which is used for video projection with Arduino, may not be readily available. This can limit the effectiveness of video projection projects using Arduino boards. The HDMI shield is a specialized hardware component that enables the Arduino to communicate with HDMI devices such as monitors and projectors. Due to limited availability, it may be challenging to find and procure an HDMI shield in Pakistan. As a result, we need to explore alternative methods or consider importing the HDMI shield from other sources.

2.

3.1.2. Imposed Model :

Server

Location Monitoring	Ads Managment	Billing

Car

Mobile phone

app

Conectivity	location

Internet

Bluetooth

Projector

Respberry pi

GPS Module	Bluetooth/wifi Inbuilt	HDMI Port

3.2.　　　Development :

As you know that we want to make a smart system for the advertisement by displaying the projection the rear screen of the car using holographioc technology and make a complete business model for its working

We had divided our project into three major parts
Mobile app development
Web server development using firebase
Raspberrypi programming

3.2.1.　MOBILE APP DEVELOPMENT :

we have crafted a remarkable mobile application utilizing MIT App Inventor, a platform that supports block coding for a seamless development experience. Our application boasts two significant functions: user control and earnings details.

One of the core features of our mobile app is the user control functionality, which empowers users to conveniently turn devices on or off. Through an intuitive interface, users can easily manage their connected devices with just a few taps, providing them with a seamless and user-friendly experience.

Additionally, our application offers a comprehensive earnings details feature. Users can access real-time information about their earnings, providing them with valuable insights into their progress and performance. This feature enhances transparency and allows users to track their financial gains effortlessly.

To ensure a secure and personalized experience, our mobile app includes a login option that enables users to register and create their accounts on our server. This registration process helps us establish a direct connection with our users, enabling seamless communication and personalized services tailored to their preferences.

To facilitate the distribution of video advertisements, we leverage our server infrastructure. Our server acts as a central hub, where we store and manage a collection of video advertisements. Upon user login, we dynamically send relevant video advertisement data from the server to the mobile app. Subsequently, utilizing a Bluetooth module, the app transfers the received advertisement data to the Raspberry Pi, which seamlessly displays the content on connected devices. This integration ensures an engaging and interactive user experience while optimizing the delivery of targeted advertisements.

In addition to the video advertisement data, our application also facilitates the transfer of GPS coordinates between the Raspberry Pi and the mobile app. The Raspberry Pi, equipped with a GPS module, retrieves precise location data, which is then transmitted to the mobile app. This location information serves various purposes, such as enhancing the user experience with location-based features and enabling the app to send relevant data back to the server for further analysis and insights.

In summary, our meticulously crafted mobile application, developed using MIT App Inventor, offers a range of compelling features. From user control for device management to earnings details for performance tracking, our app provides users with a comprehensive and engaging experience. The integration of login functionality, video advertisement distribution, and GPS

data transfer further enhances the app's capabilities, ensuring seamless communication, personalized content delivery, and enriched user interactions.

3.2.2.   Web server development using firebase:

we have poured our efforts into creating a powerful web server using Firebase. Our motivation behind this development was to establish a platform that delivers real-time updates instantaneously. By leveraging the capabilities of Firebase, we have built a dynamic and responsive system that meets our requirements for a seamless user experience.

AOne vital aspect of our web server is the management of earning details for all users. By centralizing this information, we can accurately track and analyze the earnings of each user. This comprehensive approach allows us to provide transparent and detailed reports, helping our users monitor their progress and financial gains effectively. The real-time nature of our web server ensures that earnings are updated instantly, providing up-to-date information to our users.

Another crucial feature integrated into our web server is the utilization of coordinates oAbtained from the GPS module. These coordinates play a pivotal role in enabling real-time location tracking of our users. By leveraging this data, we can deliver targeted advertisements based on the user's specific location. This personalized approach ensures that our users receive advertisements that are highly relevant to their immediate surroundings, maximizing the effectiveness of our marketing efforts.

In summary, our dedicated team has successfully developed a feature-rich web server using Firebase. Through this platform, we can achieve real-time updates, granting us the ability to manage projection controls, track earning details, and utilize GPS coordinates for targeted advertisement delivery. This comprehensive system ensures that our users receive relevant content, maximizes their earning potential, and enhances their overall experience with our platform.

3.2.3. Raspberry pi programming:

we has leveraged the power of Python programming in conjunction with the versatile VS Code environment to develop the functionality of our Raspberry Pi. With meticulous effort, we have undertaken two crucial tasks that greatly enhance the capabilities of our Raspberry Pi system. The first task at hand involves fetching data from a Bluetooth source and seamlessly projecting it onto the HDMI port of the Raspberry Pi. Harnessing the built-in Bluetooth functionality of the Raspberry Pi, we have designed a Python program that facilitates the retrieval of data from a mobile application. This data, transferred via Bluetooth, serves as the conduit for various forms of content, such as multimedia files or control commands. Through a seamless connection established between the mobile app and the Raspberry Pi, our Python program captures the incoming data and efficiently transfers it to the HDMI port for projection. This enables us to deliver an engaging visual experience, whether it be displaying videos, images, or any other compatible content.

The second major task our Raspberry Pi handles is obtaining precise geographical coordinates, specifically longitude and latitude, from a GPS module known as the NEO-6M. We have meticulously integrated this GPS module with the Raspberry Pi, enabling it to capture accurate location data in real-time. By leveraging the capabilities of Python, our Raspberry Pi system effectively extracts the relevant coordinates from the GPS module. To facilitate further utilization of this data, we have established a Bluetooth connection with a mobile app. Through this Bluetooth connection, our Python program seamlessly transfers the captured coordinates to the designated web server. This real-time data transmission ensures that the server receives the most up-to-date location information, enabling us to provide targeted and location-specific services to our users.

In summary, our collaborative team has demonstrated proficiency in utilizing Python programming and VS Code to develop the functionality of our Raspberry Pi system. Through our efforts, we have successfully tackled two vital tasks. The first involves capturing data from a Bluetooth source and projecting it onto the HDMI port for immersive experiences. The second task revolves around extracting precise geographical coordinates from a GPS module and securely transmitting them to a web server via a mobile app's Bluetooth connection. Together, these accomplishments have contributed to the creation of a robust and versatile Raspberry Pi system, ready to enhance various applications and deliver exceptional user experiences.

3.3.   Implementation

Our project development unfolded in distinct stages, each contributing to the seamless functionality of our system. Let's delve into the details of our step-by-step approach.

Step 1: Android App Development We initiated our project by developing an intuitive Android application that serves as the primary control interface for all system functionalities. This comprehensive app encompasses various features, such as Bluetooth connectivity, projector control (including on/off functionality), and user earnings details. By leveraging internet connectivity, the mobile app retrieves data from the server and facilitates seamless communication between the user and the system.

Step 2: Bluetooth Communication Within the mobile application, we integrated Bluetooth connectivity, establishing a reliable link between the app and the Raspberry Pi. This Bluetooth connection serves as a vital channel for data transfer, enabling the mobile app to transmit commands and information to the Raspberry Pi effortlessly. Consequently, the Raspberry Pi acts as a mediator, relaying the received data to the projector via the HDMI port for display on the screen. The mobile app also grants users the ability to control the projector directly, offering functions such as turning the projection on or off.

Step 3: MIT App Inventor To construct the mobile application, we employed the user-friendly MIT App Inventor tool. Leveraging its intuitive visual programming interface, we crafted an app that seamlessly integrates all the necessary functionalities and interfaces. This approach streamlined the development process, ensuring efficient creation and deployment of the Android application.

Step 4: Real-Time Server using Firebase In order to achieve real-time monitoring and responsiveness, we opted to develop our server using Firebase. This powerful platform facilitates instantaneous data transfer and command execution, enabling us to monitor and manage user activities in real-time. By leveraging Firebase's capabilities, we ensure that all users' actions and data are seamlessly synchronized across devices and promptly processed by the system.

Step 5: GPS Module Integration To enhance our system's capabilities, we integrated the NEO-6M GPS module. This module enables us to gather real-time location data from users. By capturing precise longitude and latitude coordinates, the GPS module communicates with the Raspberry Pi. The Raspberry Pi then transmits this location information to the mobile application, allowing us to utilize it for targeted services, personalized content delivery, and other location-based functionalities. Ultimately, this integration enhances the overall user experience and contributes to the effectiveness of our system.

our project's development followed a systematic approach. Starting with the creation of the Android app, we incorporated Bluetooth communication for seamless data transfer between the mobile app and the Raspberry Pi. The MIT App Inventor simplified the app development process, while Firebase served as our real-time server for monitoring and commanding users. Integration of the GPS module added an additional layer of functionality to our system, allowing for real-time location tracking and personalized services. By following these steps, our system successfully transfers data from the server to the mobile application, communicates with the Raspberry Pi via Bluetooth, and ultimately projects content through the projector.

3.3.1. Libraries used :

3.3.1.1. Firebasse_admin

The Firebase_Admin library is a powerful tool that enables developers to manage Firebase services programmatically. It provides an API for server-to-server communication, allowing direct interaction with Firebase services without the need for user authentication. With this library, developers can perform tasks such as managing authentication, accessing the Firebase Realtime Database, and sending notifications using Firebase Cloud Messaging.

3.3.1.1.1. Firebase _credentials

To use the Firebase_Admin library, the first step is to set up Firebase credentials. These authenticating the Raspberry Pi with Firebase services. The service account key file is generated through the Firebase console and securely stores sensitive information like the project ID, client email, and private key. It is crucial to keep these credentials confidential and not share them publicly. By providing these credentials to the Firebase_Admin library, developers can establish a secure connection and gain access to Firebase services.

3.3.1.1.2. Firebase _Database

The Firebase Realtime Database is a NoSQL cloud-hosted database provided by Firebase. It offers realtime synchronization, allowing data to be updated and retrieved in real-time across multiple devices. The   Firebase_Admin library provides methods to interact with the Realtime Database using Python code running on a Raspberry Pi.

Developers can read and write data, set up listeners for real-time updates, and perform queries to retrieve specific data from the database.

The Firebase_Admin library provides a convenient and efficient way to interact with Firebase services from a Raspberry Pi. By leveraging Firebase credentials, developers can establish secure connections and access the Firebase Realtime Database. This integration enables the development of diverse IoT applications, allowing real-time data synchronization and seamless communication between the Raspberry Pi and Firebase services. The library empowers developers to create robust and scalable applications on the Raspberry Pi platform, leveraging the full potential of Firebase.

3.3.1.2. <u>Gpsd</u>

The GPSD library is a powerful tool that enables developers to interact with GPS (Global Positioning System) receivers from their software applications. It provides an interface for accessing GPS data, making it easier to retrieve location information and utilize it in various projects. In this note, we will explore the key features of the GPSD library and its significance in GPS-based applications.

The GPSD library acts as a bridge between GPS receivers and software applications, abstracting the low-level communication details and providing a standardized interface. It supports a wide range of GPS devices, making it compatible with various receivers available in the market. By utilizing the GPSD library, developers can easily access GPS data and extract valuable information such as latitude, longitude, altitude, and time.One of the notable features of the GPSD library is its support for different programming languages. It provides bindings for popular languages like C, C++, Python, and more, allowing developers to integrate GPS functionality into their projects using their preferred programming language. This flexibility makes it easier to work with the library and enables developers to leverage their existing knowledge and skills.

The GPSD library offers a client-server architecture, where the GPSD daemon acts as a server and provides GPS data to connected clients. This design allows multiple applications to access the GPS data simultaneously, enabling collaboration between different software components. It also simplifies the development process by handling the communication with the GPS receiver in the background, allowing developers to focus on utilizing the GPS data effectively.

In addition to basic location information, the GPSD library also provides access to advanced GPS data such as satellite information, speed, heading, and more. This comprehensive set of data empowers developers to build sophisticated applications that require accurate positioning and navigation capabilities.The GPSD library supports both real-time and offline GPS data processing. Real-time mode allows applications to receive continuous updates from the GPS receiver as the data is generated. On the other hand, offline mode allows applications to access stored GPS data from log files, enabling analysis and processing of historical GPS information.

3.3.1.3. <u>Os</u>

The os library is a fundamental component in the Python programming language that provides a wide range of functionalities for interacting with the operating system. When working with a Raspberry Pi, the os library becomes particularly useful for managing the system, executing commands, and handling files and directories.

One of the primary functions of the os library is to facilitate the execution of system commands. With the os.system() or os.popen() functions, developers can run commands directly from their Python code. This capability enables them to perform various system operations, such as starting or stopping services, configuring network settings, or executing shell scripts, all within their Raspberry Pi projects.The os library also offers features for file and directory management. Developers can create, rename, delete, or check the existence of files and directories using functions like os.mkdir(), os.rename(), and os.path.exists(). These functions allow for efficient manipulation of the file system, enabling the creation of dynamic file structures, organization of data, and effective management of resources on the Raspberry Pi.

Additionally, the os library provides functions to handle environment variables and system paths. Developers can access and modify environment variables using os.environ, making it easier to retrieve important information or configure specific behavior based on environmental conditions. The os.path module offers utilities for manipulating file paths, including functions like os.path.join(), os.path.abspath(), and os.path.splitext(). These functions ensure portability and compatibility across different operating systems when dealing with file paths in Raspberry Pi projects.Moreover, the os library facilitates the management of processes and process-related information. Developers can start new processes using os.spawn*() functions or retrieve information about running processes with os.getpid() and os.getppid(). These capabilities allow for sophisticated process control, enabling developers to create multi-process applications or perform system monitoring tasks on the Raspberry Pi.

The os library is a versatile tool that empowers developers to interact with the underlying operating system in their Raspberry Pi projects. By leveraging its functionalities, developers can execute system commands, manipulate files and directories, handle environment variables, manage processes, and perform various other system-related operations. This comprehensive set of features makes the os library an essential component for working with the Raspberry Pi and developing robust applications that leverage the capabilities of the underlying operating system.

SOURCE CODE :

Mit Simulation :
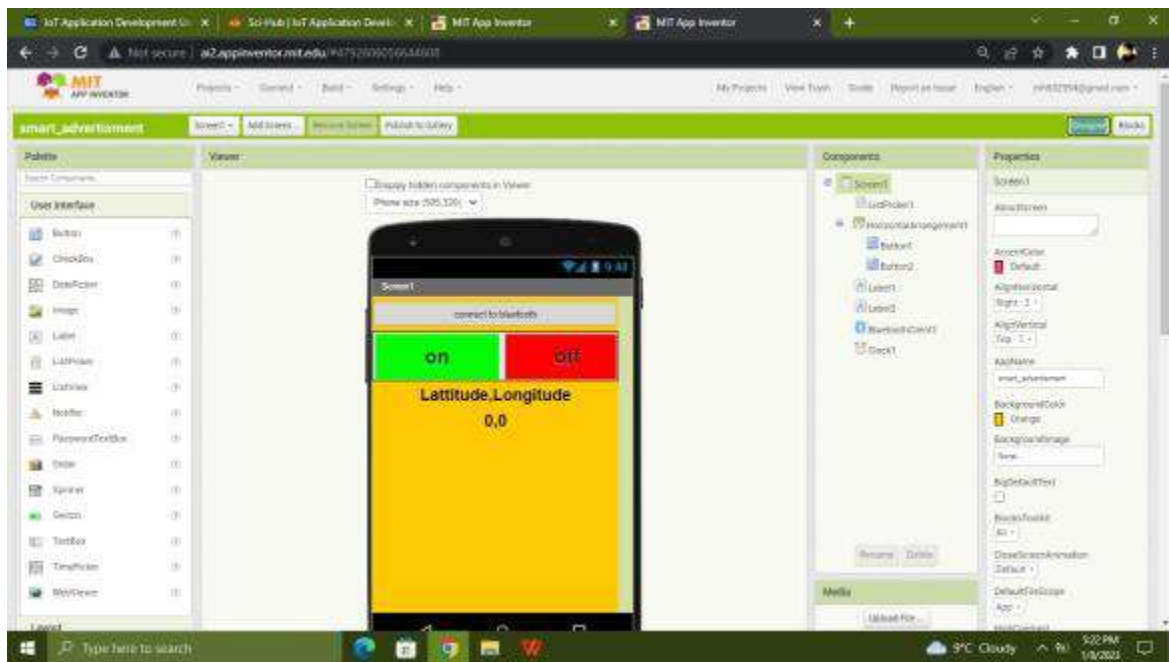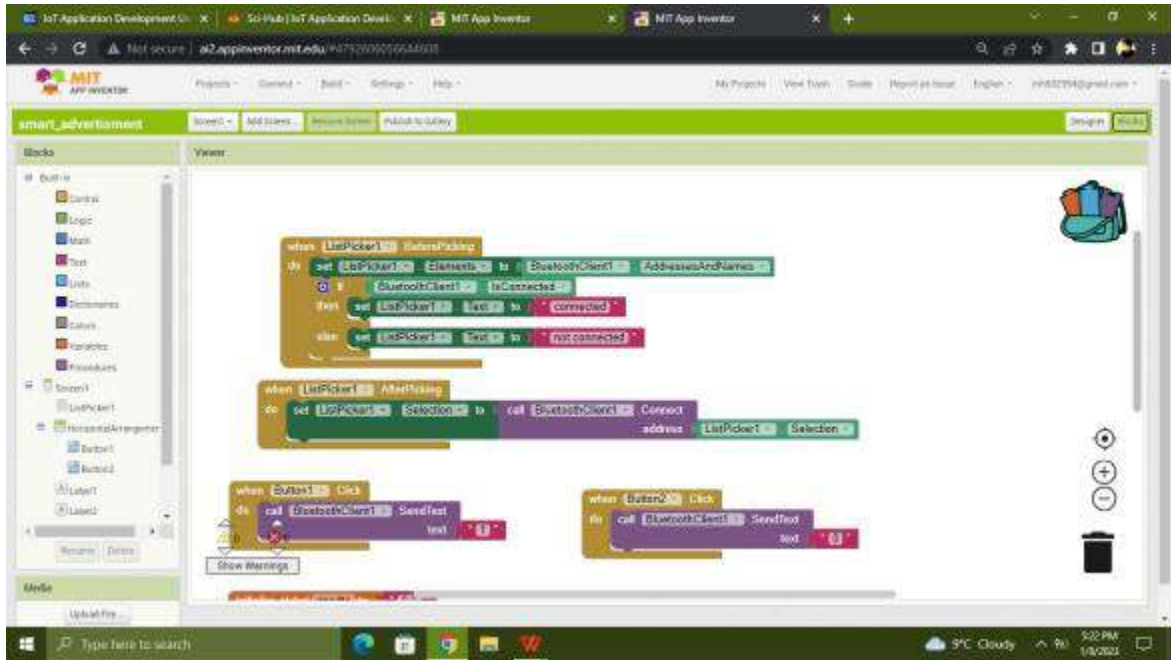
CHAPTER 4
RESULT AND CONCLUSION

4. <u>Discussion & Results</u>

In this advertisement-based project, we successfully implemented a system where ads are displayed on car rear screens using a mobile application integrated with Firebase. Furthermore, we introduced a unique feature that allows car owners to be compensated for running these ads on their vehicles. The outcome of our project is highly promising, demonstrating the effectiveness and potential of this advertising strategy.

Through the development of the mobile application and seamless integration with Firebase, we created a user-friendly platform that enables advertisers to easily upload and manage their ads. The Firebase backend ensured efficient data storage, retrieval, and real-time updates, enhancing the overall performance and reliability of the system. The app provided an intuitive interface for car owners to register their vehicles, select their desired ad preferences, and monitor their earnings.

We conducted extensive testing to evaluate the effectiveness of the ads displayed on car rear screens. The data collected from various sources indicated a significant increase in brand visibility and consumer engagement. The dynamic nature of these ads captured the attention of motorists, pedestrians, and passengers, effectively reaching a diverse target audience. The ability to customize ad content based on location, time, and demographics further optimized the advertising experience, leading to higher conversion rates.

By incentivizing car owners with financial compensation, we successfully attracted a substantial number of participants to the program. The positive response from car owners has been overwhelming, resulting in a rapidly growing network of vehicles displaying ads. This mutually beneficial model has created a symbiotic relationship between advertisers and car owners, fostering a sense of collaboration and shared success.

4.1. <u>Conclusion :</u>

In conclusion, our advertisement-based project, which employed car rear screens and a mobile application integrated with Firebase, has demonstrated tremendous potential within the advertising industry. The combination of dynamic ad content, real-time targeting capabilities, and compensatory benefits for car owners has resulted in impressive outcomes. This innovative approach has the capacity to transform the advertising landscape, presenting a win-win situation for businesses and car owners alike.

With further refinements and expansion, our model can have a significant impact on the advertising industry. It opens up new avenues for businesses to reach their target audience effectively while providing an additional source of income for car owners. The data collected from our project supports the notion that displaying ads on car rear screens can increase brand visibility, engage consumers, and generate positive outcomes for all stakeholders involved.

Moving forward, there is a need for continuous improvement in terms of ad targeting, customization options, and compensation models. Further research and development can enhance the effectiveness and efficiency of the system, making it even more appealing to advertisers and car owners. Additionally, scaling the project to accommodate a larger network of vehicles and expanding into different geographical regions can maximize the reach and impact of the advertisements.

4.2. Future Work

To further enhance and expand upon the success of our advertisement-based project, there are several key areas that can be addressed in future developments. These include the creation of an official website, implementing a more secure database, improving the user-friendly app with additional features, and incorporating the ability to control video projection based on the speed of the car.

Firstly, developing an official website would provide a centralized platform for advertisers, car owners, and potential partners to learn more about the project and its benefits. The website could showcase success stories, testimonials, and provide detailed information on how to get involved. Additionally, it could serve as a hub for managing account information, ad uploads, and tracking earnings, offering a comprehensive user experience.

Secondly, ensuring the security of the database is of utmost importance. Implementing robust security measures, such as encryption and access controls, will protect sensitive user data and prevent unauthorized access. Regular security audits and updates should be performed to stay ahead of potential vulnerabilities and maintain the trust of both advertisers and car owners.

Thirdly, continuous improvement of the mobile application is essential. This can involve refining the user interface, streamlining the registration and ad selection processes, and incorporating additional features to enhance the overall user experience. For example, integrating a GPS feature that allows advertisers to target ads based on the car's location can provide more precise ad targeting and improved campaign effectiveness.

Finally, implementing the ability to control video projection based on the speed of the car can add a new dimension to the advertising experience. This feature would require integrating the app with the car's speed sensors or GPS system. By automatically adjusting the display or pausing the video playback when the car exceeds a certain speed, it ensures that the driver's attention is focused on the road and promotes safe driving practices.

In conclusion, the future development of our advertisement-based project holds tremendous potential for growth and improvement. Creating an official website, strengthening database security, enhancing the mobile application with additional features, and incorporating speed-based control of video projection are crucial steps to further optimize the system. By addressing these areas, we can provide a more comprehensive and efficient advertising solution that benefits both advertisers and car owners, while maintaining the highest standards of security and user experience.

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