

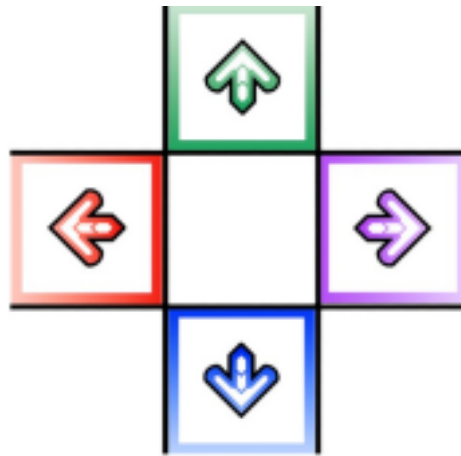


An-Najah National University

Faculty of Engineering and Information
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Department

Graduation Project II

Let's Dance!



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Submitted in partial fulfilment of the requirements for the *Bachelor degree in Computer Engineering*

May, 2023

Acknowledgements

First and foremost, we express our sincere thanks and heartfelt gratitude to God. Without His blessings that guided us every step of the way, we would not have achieved successful completion of this project.

We extend our heartfelt gratitude to our dear parents and beloved families. Thank you for the unwavering support that has consistently uplifted our spirits. Your kind and encouraging words have been a solid foundation upon which we have leaned and drawn strength from.

Our esteemed supervisor, Dr. Raed Qadi, we express our heartfelt gratitude for your invaluable guidance, always delivered at the most opportune moments. We are also grateful for the enriching discussions, insightful comments, and constructive criticism you provided, which greatly enhanced the project's capabilities. We extend our thanks to the Computer Engineering Department at An-Najah National University for their support, as well as to the friends who accompanied us throughout this journey.

Lastly, we would like to express our heartfelt appreciation to all those who have contributed in any way and provided invaluable assistance. Your support means a great deal to us.

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Disclaimer

Aya Khalifa and Misam Kamal Mousa collaborated on the completion of this paper. The authors acknowledge full responsibility for any errors identified within. The ideas, suggestions, findings, and opinions expressed in this paper solely belong to the authors and do not reflect the viewpoint of An-Najah National University.

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Chapter 1

Abstract

In recent years, gaming has become super popular all around the world. People really like games where they can play and feel like they're in the action. You know this dance pad? Well, we're making it even cooler in our project. We're figuring out a way to make the dance pad works with any computer game Wirelessly. And that's not all – we're also making on special glove and gun-like devices that you can use to play games on the computer, just like using a mouse. Imagine wearing a glove and waving your hand to control a game, or using a gun-shaped thing to aim in a game. It's all about making games feel real and exciting.

The primary goal of this project is to develop an interface that empowers players to control computer games wirelessly using the arrow keys from a keyboard. Through the utilization of Bluetooth technology, these arrow keys on the dance pad would essentially function as a wireless keyboard, opening up new avenues for interactive game-play. Additionally, a similar concept extends to single glove and gun peripherals, effectively turning them into wireless input devices for a variety of games via Bluetooth connectivity.

One awesome way to make games more fun is by adding RGB-Strips to the dance pad. These lights show up when you jump on the pad. And guess what? When you jump on the pad, you'll even hear tone, making the game even more thrilling for you.

The technical implementation of this project involves the utilization of ESP32 to establish a Bluetooth connection with the computer. This integration ensures seamless communication between the dance pad and the gaming system. Simultaneously, the project leverages ESP8266 to link the dance pad with a mobile application. This connection enables the tracking of calories burned during game-play, thereby integrating a fitness aspect into the gaming experience. Also, the same mobile application harnesses a pulse sensor through ESP8266 to display the player's heart rate by wearing an Electronic bracelet style monitoring.

In conclusion, the project presents an innovative convergence of physical movements, technology, and gaming. By transforming dance pad, glove, and gun peripherals into versatile wireless input devices, players are granted a new dimension of interaction. Adding LEDs and voice feedback further elevates the immersive quality of the gaming sessions. With Bluetooth connectivity facilitated by ESP32 and WiFi connectivity by ESP8266, this project not only enhances game-play but also introduces elements of fitness monitoring and health awareness into the gaming world.

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Chapter 2

Introduction

2.1 Problem

In the past few years, many people all over the world have really liked playing games. They enjoy games where they can join in and feel like they're really inside the game. One thing they use is a dance pad, like a special mat they step and jump on to play. But there's a problem – these dance pads can't be used with all computer games, especially when they are connected with wires. This makes it hard for players to fully enjoy lots of different games on their computers.

2.2 Objective

The main goal of this project is to make gaming more exciting and immersive. We want to make the dance pad work with any computer game without wires. We're also creating special glove and gun-like devices to control games like using a mouse wirelessly. The aim is to make games feel real and fun. We're adding colorful lights to the dance pad that light up when you play and even sounds to make it more thrilling. This project also uses technology to track calories burned during game-play and show your heart rate. Overall, we want to make gaming interactive, healthy, and really enjoyable.

2.3 Scope Of the Work

Improving the interaction between physical movements, technology, and gaming. We're making the dance pad, glove, and gun peripherals into wireless controllers. Adding lights and sounds will enhance the gaming experience. By using Bluetooth and WiFi connections, the project aims to enhance game-play and introduce fitness and health tracking into the gaming world.

2.4 Importance

The importance of this project lies in making gaming even more exciting and engaging. As gaming becomes increasingly popular worldwide, people seek experiences where they can actively participate and feel like they're part of the action. The project aims to enhance a device called a dance pad, which players use to interact with games through physical movements.

The project's focus includes making the dance pad work with any computer game wirelessly, which currently isn't possible. This would open up new possibilities for players to enjoy a wider range of games without the hassle of wires. Additionally, the project involves creating special glove and gun-like devices for game control, providing players with unique and immersive ways to play, much like using a computer mouse.

By incorporating features like colorful lights and sounds, the project aims to make games even more enjoyable and lifelike. The introduction of Bluetooth technology and the use of devices like ESP32 and ESP8266 further demonstrate the project's dedication to merging technology, physical activity, and gaming into an innovative and health-conscious experience. Overall, the project seeks to offer players a fresh way to interact with games, fostering engagement, enjoyment, and well-being.

2.5 Report Organization

The first chapter is the abstract which offers a succinct preview of the project, underscoring its importance and key components. The second one is about the introduction which introduces the project's context, emphasizing the surge in gaming's popularity and the yearning for immersive experiences. It also sets the stage for the concept of enhancing the dance pad and other innovative game control methods. The following chapter is chapter three, we will talk more about the problems we faced while creating this system, and section concurrently spotlights the essential courses and knowledge necessary for the successful execution of the project. Chapter 4 is the literature review, offers context through discussing related endeavors within the same domain. Chapter 5 is the methodology, it Used to achieve project goals, this part explains the step-by-step method, tools, and technologies creatively used to create the improved gaming system. Chapter 6 is the results and discussion, it will go over what happened as a result of the project. Finally, chapter 7 will discuss and talk about the conclusion and recommendation.

Chapter 3

Constraints and Earlier coursework

3.1 Constraints and limitations

1. Time limit: This is the first time we're creating an integrated device right from scratch, It has parts we're not very familiar with, so we had to figure out what they

do and how to use them. We also had to learn about Arduino and write instructions for the device. Putting everything together to make it work was a bit hard, especially because we had other things to do during the summer semester like other projects and assignments.

2. Internet connection: We have 2 NodeMCU ESP8266 need to connect to Wi-Fi to send information to the mobile phone application, we had a problem with the internet going off, so we need to stay where there's Wi-Fi all the time.
3. Budgetary Limitations: Creating the hardware for the dance pad needs to fit into a certain budget. The money limit might affect the materials, parts, and technologies chosen for the model. We might need to think about cheaper options that still work well and don't change what the hardware does.
4. Hardware Availability: While making the dance pad, getting the right parts might be a problem. If some parts or sensors are hard to find, we might have to use different ones instead. We made the hardware model while thinking about what parts we could get and if they work together.
5. Size and Weight :We had some trouble making our project's design. It was because of how big and heavy and it must often fit within specific size and weight constraints.
6. Power Distribution :It had lots of parts, and each part needed a different amount of power and voltage, like RGB-Strip need 12v and ESP32 need 10v and MP3 need 5v.

3.2 Earlier coursework

While learning computer engineering, we studied different subjects like digital design, micro processors, electrical circuits, electronic circuits, and micro-controllers. These subjects helped us create the system. We also took online classes to learn what we needed for our project. We learned some important things about Arduino and how to write code for it.

Chapter 4

Literature Review

We reviewed several previous papers about wireless mice, keyboards, smart heart rate watches, and dance pads to use their features in our graduation project. Nowadays, many dance pads only support a single game when connected via wires.

- We're planning a project with a special pad that connects to the computer through Bluetooth. This pad encourages foot movement, similar to a dance game, while you use the computer. We believe it's a great idea because it promotes better health by getting you to move more. It's also enjoyable and can help prevent issues like wrist pain from excessive typing. We've seen similar projects like StepMail and StepPhoto (2) that use this pad, and people found them user-friendly and enjoyable. Our goal is to create a project that's both fun and beneficial for computer users. We got the inspiration for our project from a

research paper we mentioned earlier.

- Bluetooth adds an extra layer of enjoyment to games, enabling players to physically engage with both the game and other players. It seamlessly blends the virtual and real worlds, particularly in games played using wearable computers. Bluetooth's capabilities enhance the overall gaming experience, making it more exciting and real.(1)
- Monitoring heart rate is essential for understanding and maintaining heart health. Pulse sensors, as discussed in (5) research, offer an economical and accessible means of tracking heart rates. This technology plays a vital role in early detection of heart-related problems, facilitating timely intervention and management. Smith's study findings significantly enhance the field of heart rate monitoring in healthcare and research, ultimately helping individuals monitor their health more effectively.

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Chapter 5

Methodology

5.1 Technical choices

- Arduino Arduino is an open source. It helps to make things with electricity. It's user-friendly platform that enables people to create various electronic projects without needing extensive technical expertise (3). Arduino board have different parts that work together. Arduino has lots pins, that you can use to connect it to different parts. There are two kinds: 14 digital I/O pins and 6 Analog pins. It also has places to get power and serial connector. The most important part of Arduino called a microcontroller. You can program it what to do by writing commands. It also has some extra stuff inside(4).
- Libraries
 1. HardwareSerial: used to connect the ESP32 and Arduino Mega together through a serial connection
 2. BlynkSimpleEsp8266: used to connect the NodeMCU esp8266 and Arduino Mega together through a serial connection.
 3. SerialMP3Player: We used the SerialMP3Player to manage audio and sound effects, enhancing the gaming experience with relevant sounds.

4. BleKeyboard: The BleKeyboard was employed to establish a Bluetooth connection, transforming the dance pad into a wireless keyboard for controlling computer games.
5. SoftwareSerial: This library provides software-based serial communication for situations.
6. Wire: This library allows our Arduino to communicate with devices over the I2C (Inter-Integrated Circuit) bus, we use it to communicate with an IMU (Inertial Measurement Unit) sensor (MPU6050) connected to your Arduino via I2C
7. ESP8266WiFi: used to connect NodeMCU to the internet.
9. BleMouse: This library is likely a custom or third-party library that allows our ESP32 to act as a Bluetooth Low Energy (BLE) mouse. It provides functions for simulating mouse movements and clicks over a BLE connection.

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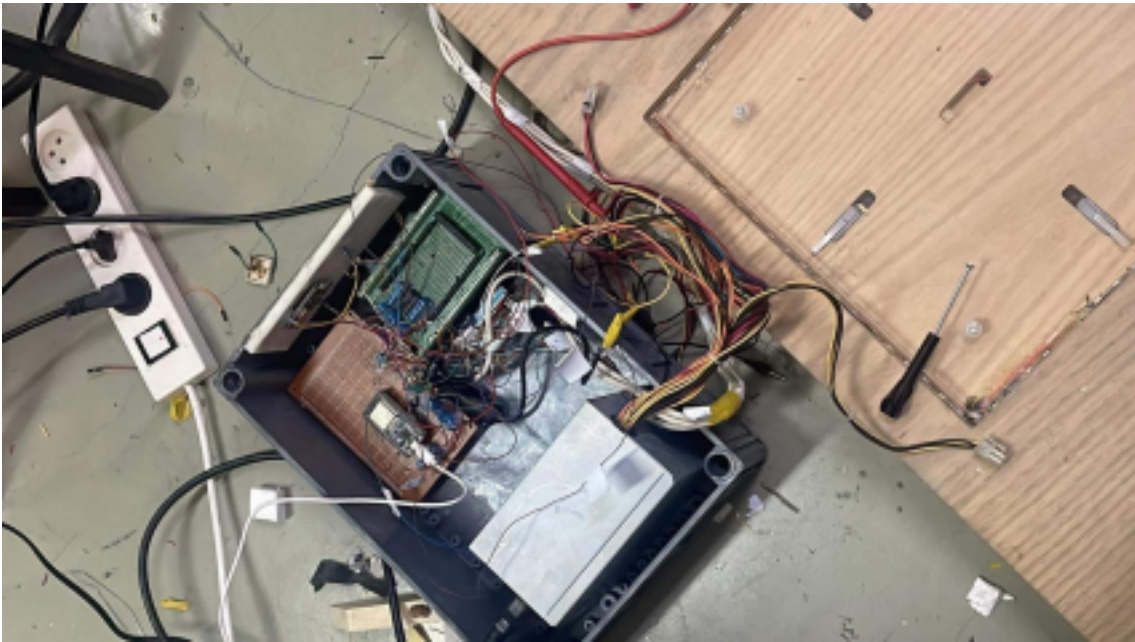
CHAPTER 5. METHODOLOGY 7 5.2 Methods and techniques

5.2.1 External design

- Dance pad: We made the dance pad 1 meter by 1 meter so players can feel comfy while playing. It's made of strong oak wood and has 4 squares emptied used screws and springs and attach a see-through plastic sheet (acrylic), so when someone steps on it there are colorful lights that shined. The electronic parts are at the back, with a special path for the wires. They all go into a box to stay safe.



(a) Front side (b) Back side



(c) The box

Figure 5.1: Dance pad

- Electronic Bracelet:

The bracelet is designed to carry a small board and straps have been installed on it, as it is similar to smartwatches.

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- Electronic glove:

The glove is designed to hold a tiny board and electronics pieces.

- Electronic gun:

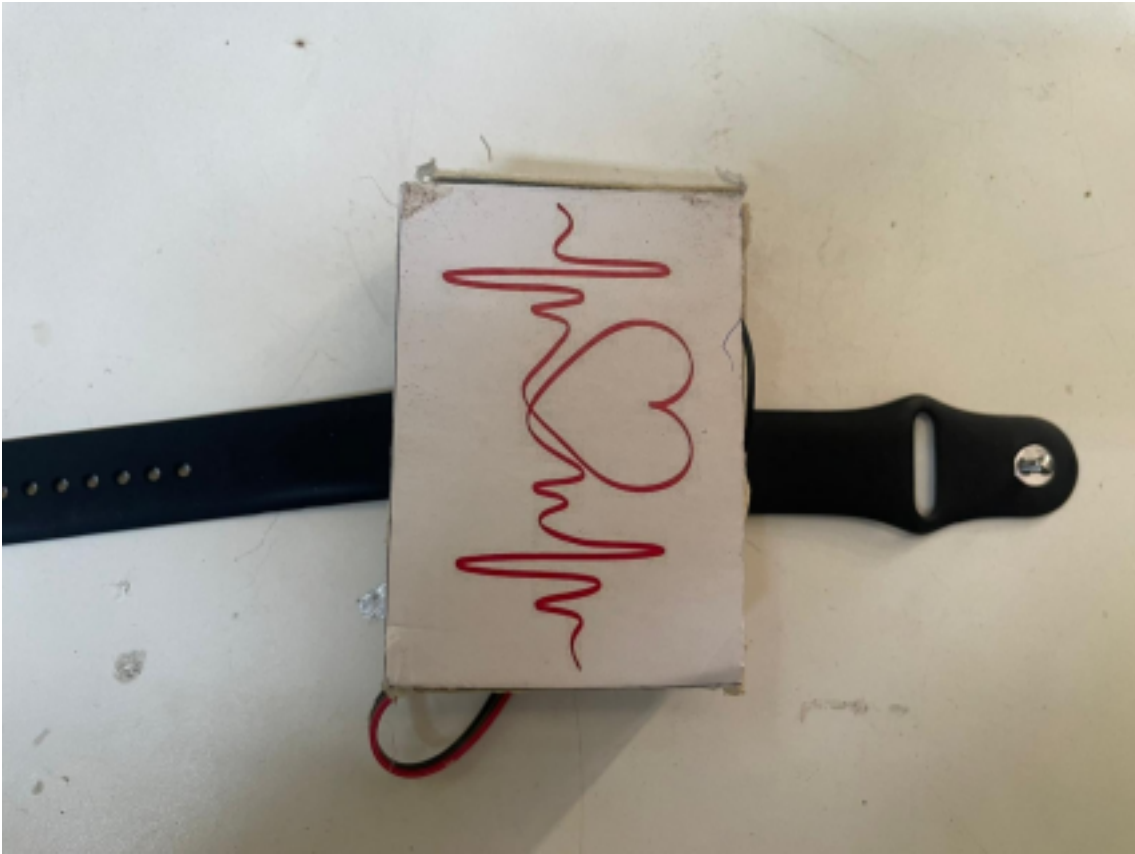
The gun is designed to hold an electronic pieces inside it.



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(a) Front side (b) Back side



(c) Electronic Bracelet

Figure 5.2: Electronic Bracelet



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(a) Inside Electronic glove (b) Electronic glove

Figure 5.3: Electronic glove



(a) Inside Electronic gun (b) Electronic gun

Figure 5.4: Electronic gun

5.2.2 Electronic components

- Dance pad:

In our setup, we had two main parts: the ESP32 and the Arduino Mega. The MP3 player and RGB-Strip lights were connected to the Arduino Mega because it works well with those and has the right pins to connect them. The ESP32 was connected to the Arduino Mega with a wire, so they could talk to the computer using Bluetooth. We also had a NODEMCU ESP8266 that sent the calories the user burned while playing to a mobile app without any wires, using WiFi. All of these parts were put inside a box.

- RGB-Strip: When the player steps on the acrylic square with a button, it lights up.
- MP3 and Speaker: When the player steps on the acrylic square with a button, a voice comes out.
- Wires: to connect the micro-controllers and connect it with resistance and to connect the component.
- Resistance: 1k and 2.2k between Arduino-Mega and ESP32 and between Arduino Mega and NODEMCU ESP8266 to protect them from burning.
- Power supply: to supply the power.

- Electronic Bracelet:

The main thing we used in this system was NodeMCU ESP8266. It has the pins we need it for our connections. You can see all the parts on the bracelet's board.

We connected NodeMCU ESP8266 to these electronic parts:

- Pulse sensor: it is heart-rate sensor.
- Battery: to supply the power.
- Wires: to connect the components.

- Electronic gun:

The main thing we used in this system was NodeMCU ESP8266. It has the pins we need it for our connections. You can see all the parts on the bracelet's board.

We connected NodeMCU ESP8266 to these electronic parts:

- MPU6050: it is six-axis we use x and y axis motion tracking device.
- Button: it's to click anything you want a play.
- Battery: to supply the power.
- Wires: to connect the components.

- Electronic gloves:

The main thing we used in this system was ESP32. It has the pins we need it for our connections. You can see all the parts on the bracelet's board.

We connected ESP32 to these electronic parts:

- MPU6050: it is six-axis we use x and y axis motion tracking device.
- Flex sensor: it's to click anything you want a play.
- Battery: to supply the power.
- Wires: to connect the components.

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5.2.3 The process

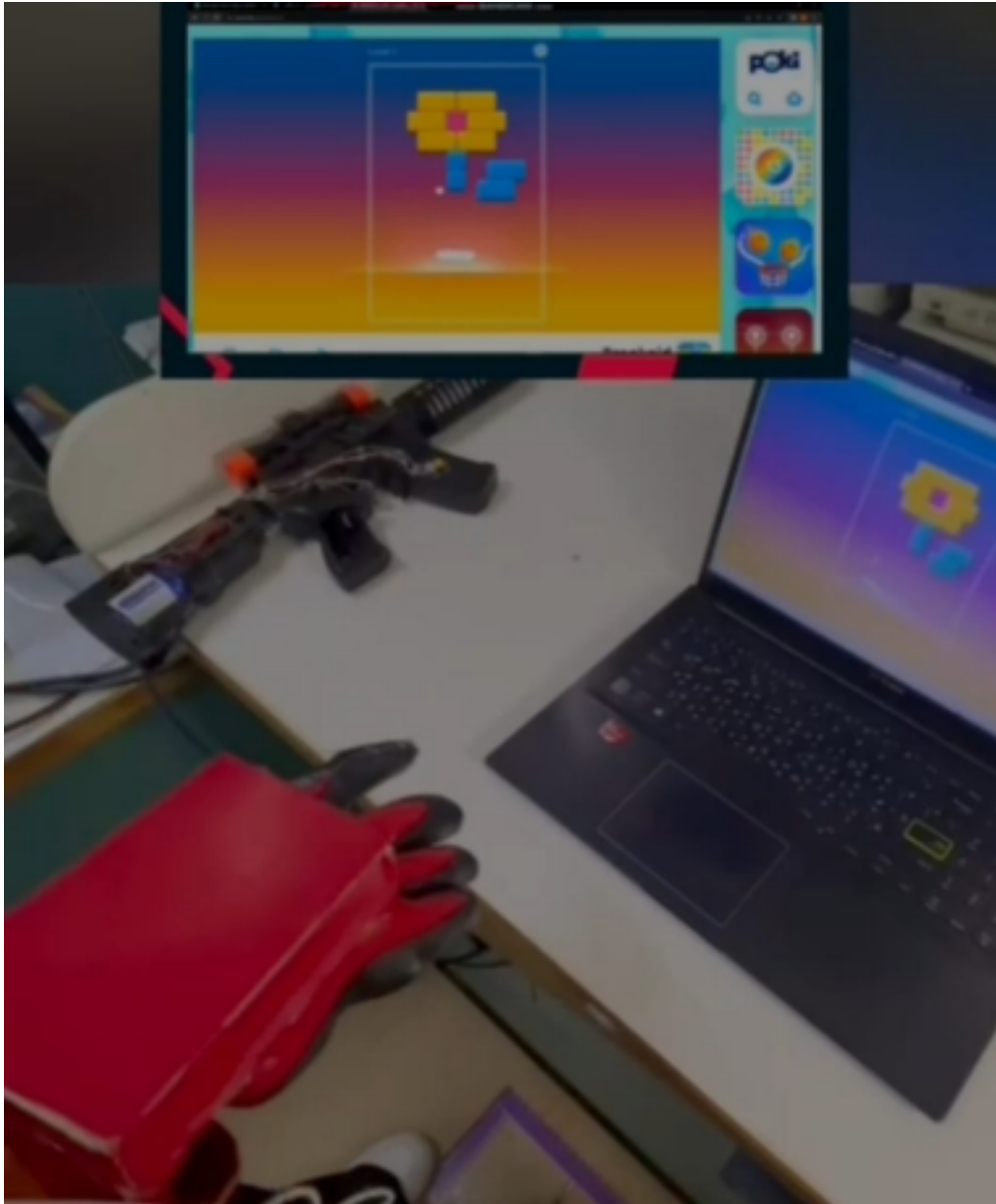
The player want to play a game, he has options, he can use a dance pad, a dance pad with a gun, a dance pad with a glove, just a glove, or only a gun. If he choose the gun, he hold it, and for the glove, he wear it.

When he's playing on the dance pad, he pushes a button on a clear square. This makes the colorful lights light up and a speaker plays a sound. All this info goes to a little computer brain called a microcontroller, as shown at 5.5



Figure 5.5: Trampled on Dance pad .

When the player wears a special glove and moves their hand or bends it's finger, the glove can make the computer act like a mouse. This happens because the glove has small parts inside it called the MPU and the flex sensor. The MPU senses how the hand is moving, and the flex sensor notices when the finger bends. When the finger bends in a certain way, the computer acts like someone clicked the mouse. It's like a fun way to control the computer! as shown in figure 5.6



Figure

5.6: Wear the glove and engage in play.

When the player holds a special gun and moves it or presses a button on the gun, it can make the computer function like a mouse. This happens because the gun has built-in parts like the MPU (which detects the gun's movement) and a button. When the person presses the button in a certain way, the computer behaves just like when you click the mouse. It's an interesting and creative way to control the computer! as shown in figure 5.7

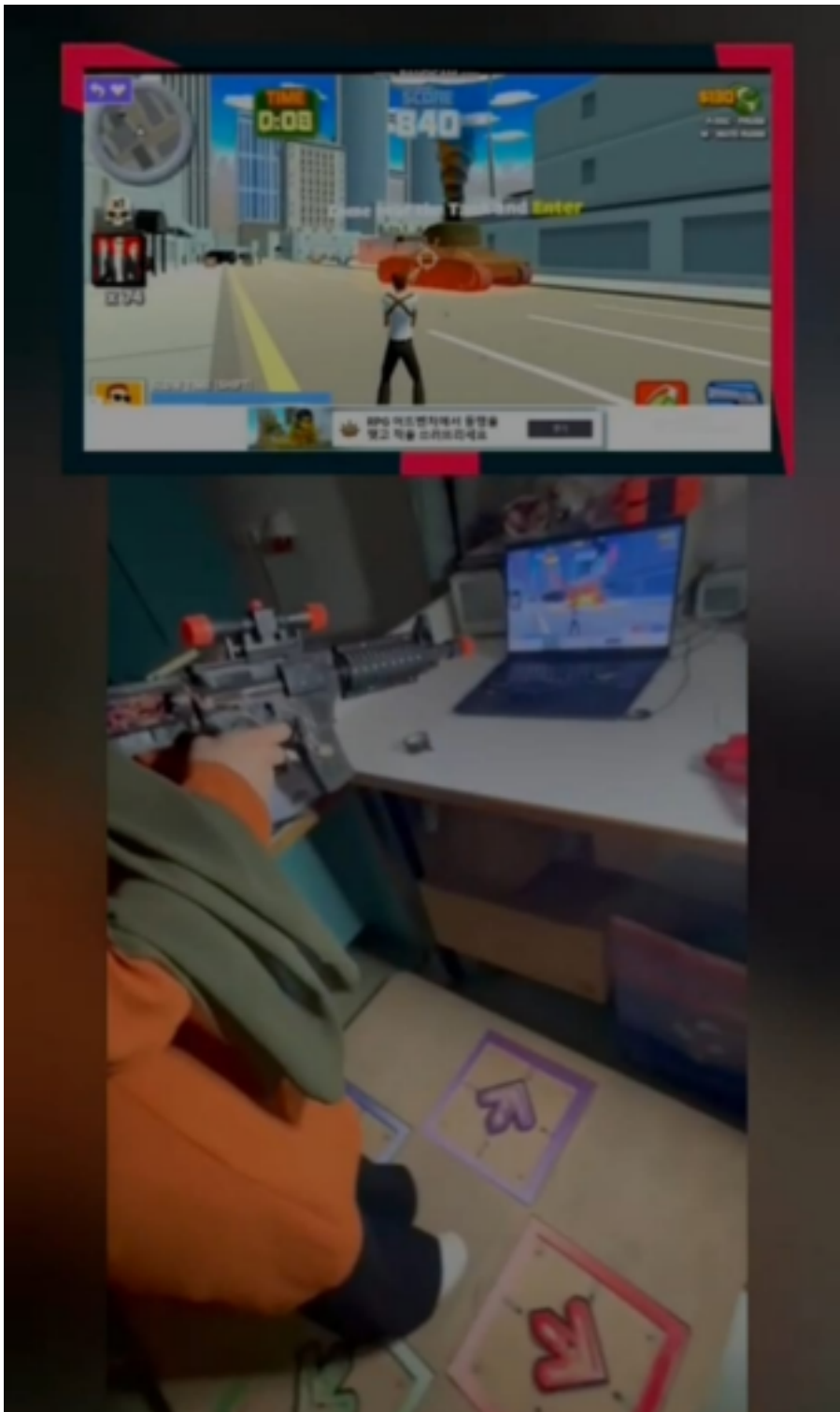


Figure 5.7: Hold

the gun and play.

While the player is playing, they put on a special electronic bracelet. This bracelet helps them know how healthy they are while having a good time. When the player isn't moving much, their heart usually beats around 60 to 100 times in a minute before they start playing, but when he's playing so the heart beats around 120 to 160 times in a minute that's measured by pulse sensor shown in figure 5.8 .

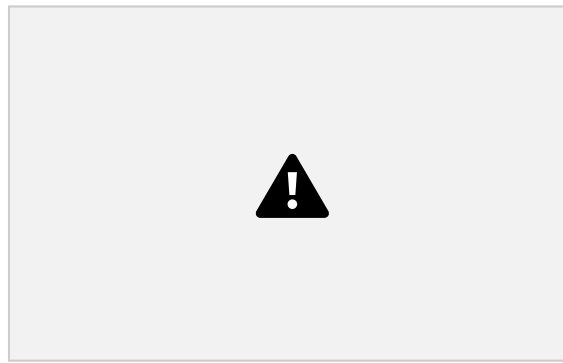


Figure 5.8: Pulse sensor.

On the player's phone, there's a special app called Blynk. It tells the player how fast their heart beats every minute and how many calories they're burning while they play. This helps the player see how their body is doing and how much energy they're using while they're having fun playing. shown in figure 5.9

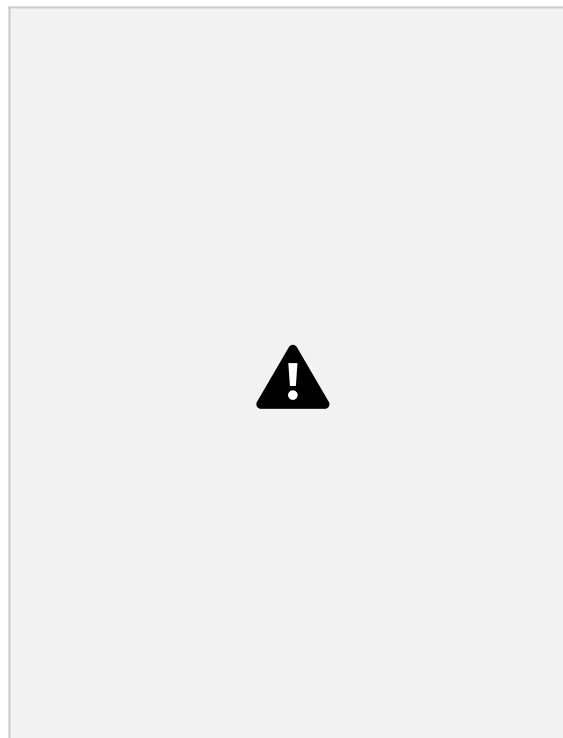


Figure 5.9: Blynk tracks heart rate and calories burned.

5.2.4 Circuits

After connecting the components together, we got the following

circuits: 1. Dance pad circuit:



Figure 5.10: Dance pad circuit.

2. Electronic glove circuit:

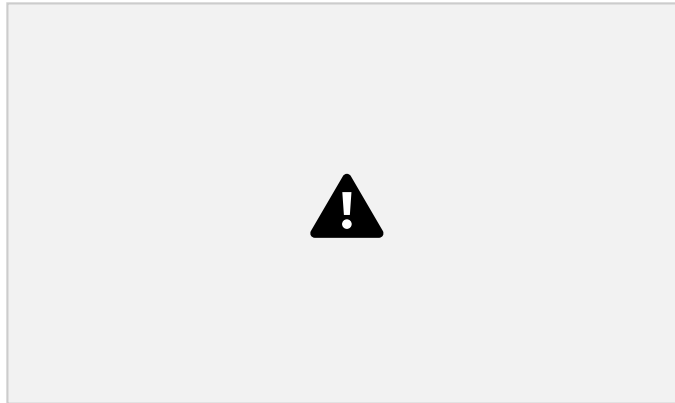


Figure 5.11: Electronic glove circuit.

3. Electronic gun circuit:

4. Electronic bracelet circuit:

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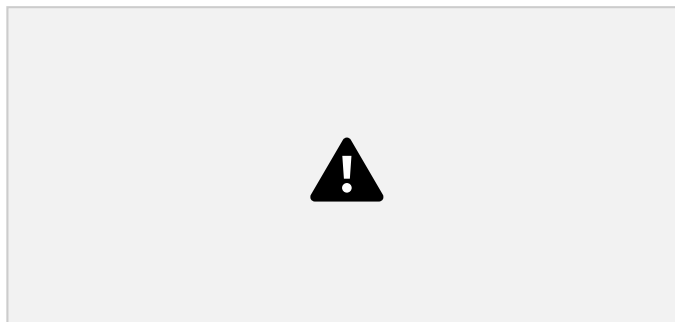


Figure 5.12: Electronic gun circuit.

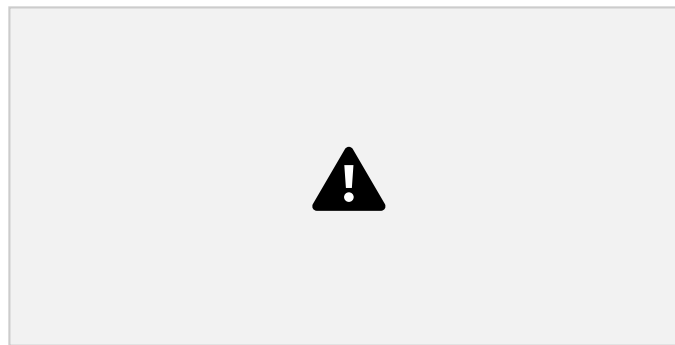


Figure 5.13: Electronic bracelet circuit.

Chapter 6

Results and Discussions

Our project successfully made gaming more interactive and exciting. The dance pad can now work wirelessly with computer games, and special gloves and gun-like controllers were created for unique gameplay experiences. The addition of colorful lights and sound effects to the dance pad added to the fun. This innovation enhances player engagement and immersion, bridging the gap between physical movement and virtual gaming. Moreover, we've introduced an electric bracelet that measures the player's pulse rate, sending the data to the Blynk platform. This added functionality provides real-time heart rate monitoring, resembling a wristwatch-style approach. Furthermore, Blynk also includes a feature that calculates the number of calories burned during game-play. This combination of pulse rate tracking and calorie calculation adds a fitness dimension to the gaming world, promoting health awareness while enjoying the gaming experience.

We learned a lot from all of this and gained experience. However, achieving our goal wasn't easy – we faced challenges, difficulties, and chances to learn new things. This chapter will talk about those experiences and obstacles.

6.1 Learning

We used new parts we didn't know about, we had to learn about them. This meant spending time to figure out how they work and using them the right way. The internet helped a lot by giving us information to learn from.

6.2 Challenges

- Initially, when we tried to connect the ESP32 with Arduino, we faced a problem where ESP32 got burnt. After some online research, we discovered a solution – we needed to create a voltage divider using a 1k and 2.2k resistance to prevent this from happening again.
- We also developed a Flask application to establish a Wi-Fi connection between the pad and the computer. This allowed us to use the PyAutoGUI library to simulate arrow clicks. However, we encountered a hurdle as this library didn't have permission to interact with games. After further research, we decided to switch to a Bluetooth connection as an alternative solution.

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Chapter 7

Conclusion and Recommendations

7.1 Conclusion

The project's main goal is to make the player feeling that he is virtually in the game and make him feeling more interactive with the game. We made this system in about three months, working all the time. Our supervisor helped and advised us a lot.

By making this project, we got better at many things:

- Dealing with Arduino as software(IDE) and hardware(microcontroller).
- Dealing with different sensors.
- Dealing with MPU6050 sensor.
- Dealing with ESP32 and making a connection with the Blynk application.
- Dealing with Arduino libraries.
- Dealing with heart rate sensor and learning how they measure pulses.
- Dealing with NodeMCU ESP2866.

7.2 Recommendations

Arduino is easy to use for making these systems. We should focus more on hands-on learning and making projects with Arduino and its tools. This will help students save time and work more effectively.

7.3 Future work

This project is in the beginning stage, We have the opportunity to incorporate additional features, functionalities, and processes that can significantly improve its effectiveness. Once these improvements are made, the project can potentially be offered to gaming establishments, allowing them to integrate it into their operations and generate revenue

from it.

- 2 or more players.
- Wireless charging.
- Expand health monitoring.

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