GUSTO UNIVERSITY

Unit-43: Internet of Things

Gesture Gloves

Submitted by: Group 6

Number of Group Member- 5

Batch-No 43

Submitted on:

June 01,2023

I. Contents

I. Introduction

Internet of things

The Internet of Things (IoT) is a network of interconnected physical devices, vehicles, buildings, and other items that are implanted with sensors, software, and network connectivity to collect and share data. In a nutshell, IoT is the process of linking common objects to the internet and allowing them to speak with one another and with us.

The idea behind IoT is to build a huge ecosystem in which devices can seamlessly gather and share information, resulting in increased efficiency, better decision-making, and enhanced automation. Simple domestic appliances such as refrigerators, thermostats, and lighting systems are examples of networked devices, as are more complicated systems such as industrial machinery, smart cities, and even wearable devices.

An IoT system's major components are as follows:

- Devices/Sensors: These are physical devices or machines that have sensors or actuators for data collection and transmission. Temperature sensors, motion detectors, GPS trackers, and other devices may be included.
- Connectivity: IoT devices use a variety of methods to connect to and interact with one another and with the internet. Wi-Fi, Bluetooth, cellular networks, and specific IoT networks such as LoRaWAN or Zigbee can all be used to accomplish this.
- Data Processing: After collecting data from IoT devices, it must be processed and analyzed. This can be done locally on the device or on the cloud, which has powerful computer systems capable of handling large-scale data processing and complex analytics.
- Cloud Infrastructure: The cloud is critical in IoT because it provides storage, processing power, and scalability for IoT data. It offers smooth access to data from anywhere and the integration of many devices and applications.
- Apps and Services: IoT generates a vast amount of data, which apps and services may use to give important insights and functionality. Smart home

automation, industrial monitoring and control systems, healthcare solutions, and many other applications are examples of these applications.

Project Members

Members Name	Roles
SAI AUNG HSO MUNG	Report and Presentation
THIN MYAT ZAW	Design and Report
PYAE PHYO THIHA	Design and Coding
SAW WIN NWE (Leader)	Main Coding
KHANT KYAW MIN	Presentation

5 wearable IoT projects

Smart Glasses for Augmented Reality (AR)

"Smart glasses for augmented reality (AR) with IoT" refers to wearable devices equipped with screens and sensors that give augmented reality experiences while being combined with Internet of Things (IoT) capabilities as of my most recent update in September 2021. These smart glasses may superimpose digital information and virtual objects over the user's real-world vision, improving perception and interaction with their surroundings.

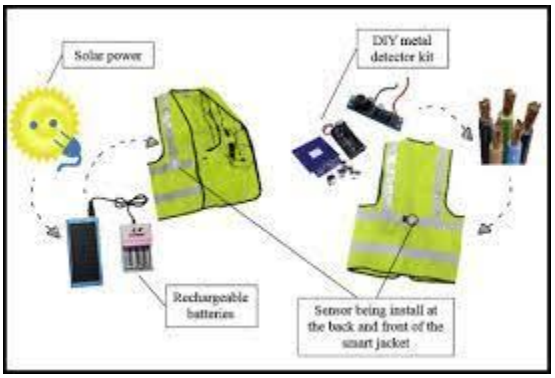
Smart Ring for Contactless Payments

A smart ring is a wearable Internet of Things gadget that serves as a contactless payment option. It has NFC (Near Field Communication) technology, which allows customers can make safe payments by just tapping their ring on compatible payment terminals. The ring may be connected to the user's bank account or

digital wallet, removing the need for physical cards or cellphones. Furthermore, smart rings can provide alerts, fitness monitoring, and even access control to connected smart locks or gadgets.

Smart Safety Jacket

A "Smart Safety Jacket" is a high-tech wearable garment meant to improve worker or individual safety and visibility in a variety of scenarios. It includes modern technology to boost visibility, communication, and monitoring features, resulting in improved safety outcomes.



Smart fitness tracker

The smart fitness tracker IoT project aims to create a wearable device that seamlessly integrates into a user's lifestyle, enabling them to lead a healthier and more active life. By leveraging a range of sensors, the tracker monitors physical activities and heart rate to provide valuable insights into the user's overall health and wellness.

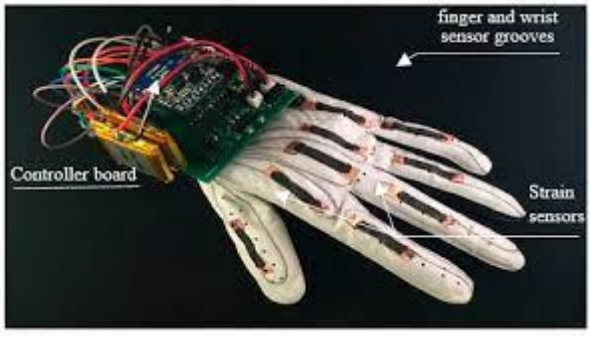
The device uses Wi-Fi to communicate with the user's smartphone, where a dedicated mobile app or cloud platform displays the collected data in an easy-to-understand format. Users can set fitness goals, track their progress over time, and receive personalized recommendations based on the data collected.

The smart fitness tracker's compact design, long battery life, and comfortable wear ability make it an essential companion for individuals seeking to stay motivated, make informed decisions about their health, and achieve their fitness objectives. Through this IoT project, users can gain a deeper understanding of their bodies, leading to improved overall well-being and an active lifestyle.

Gesture gloves

Wearable gadgets outfitted with sensors and technologies that allow users to operate electronic devices and interact with digital interfaces via hand gestures are known as smart gesture gloves. These gloves provide touchless and intuitive contact with a wide range of devices and apps, making them helpful in a variety of scenarios such as virtual reality (VR), augmented reality (AR), gaming, remote control, and human-computer interface.

Smart gesture gloves provide a natural and engaging method to engage with digital information while being touchless and intuitive. They are especially useful in virtual reality situations, where standard controls may interfere with the sense of immersion and presence.



II. Project Proposal explore of IoT Functions & Functionality

Project proposal 1- Gesture Gloves

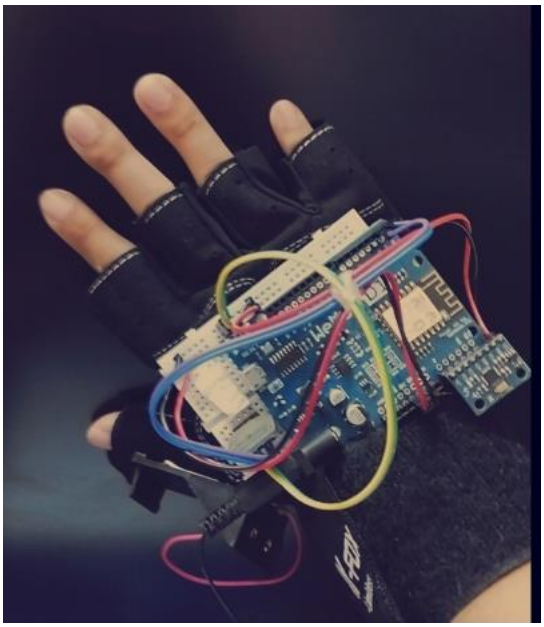
Introduction

Toy automobiles with remote controls have long been a popular source of fun for both children and adults. A new idea has developed to improve the user experience: remotely driving toy vehicles with gloves. By just wearing specially constructed gloves, users may operate numerous aspects of the toy car. In this post, we'll look at the features and details of remote-controlled toy cars that use gloves.

Gloves Design

The gloves used for remote control of toy automobiles have sensors and electronic components incorporated in. These components allow signals to be transmitted from the gloves to the toy car, resulting in a smooth control experience. The gloves are usually light and comfortable, allowing the user to move their hands freely and precisely.

Requirement
Uno Arduino Board
Adapter
MPU 6050 accelerometer sensor
Glove
Mini Breadboard
9V battery
Cable ties
Jumper wires



Gloves Design

Car Design

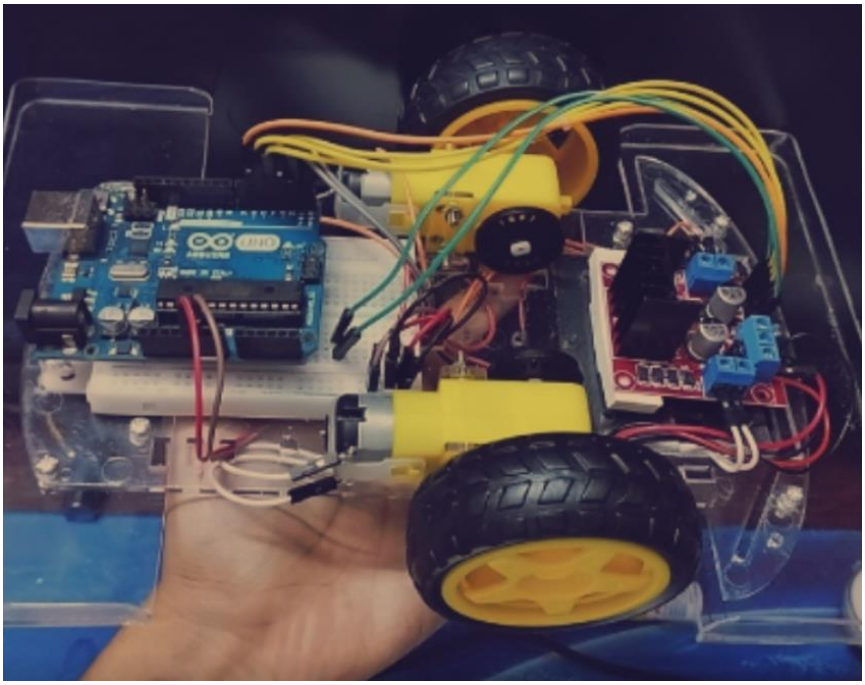
Embedded sensor modules on the car's exterior detect and interpret movements made by the driver while wearing gesture control gloves. These sensors are deliberately placed in order to correctly capture hand movements and offer seamless contact between the driver and the vehicle.

The interior design is around producing a driver-centric cockpit with an emphasis on ergonomics and comfort. The configuration allows for simple access to controls and displays while limiting distractions and allowing the driver to concentrate on the road.

Gesture Recognition System: The interior of the vehicle is outfitted with advanced gesture recognition technology that analyses signals received from the gesture control gloves. This technology reads the driver's hand movements and converts them into particular commands for the car's numerous functions.

Interactive Displays: The car has interactive displays that give the driver visual input. These displays can show icons or animations that reflect the identified gestures and their associated functions, ensuring clear communication between the driver and the car.

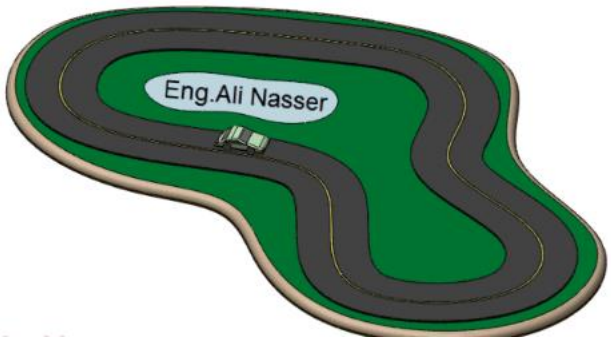
Requirement
Uno Arduino Board
Antenna
Adapter
Bridge motor
Mini Breadboard
batteries
Cars
Jumper wires



Car Design

Road Design

Plan A: All of our group member will physically draw the road design like the actually road in real world and use coloring to make more realistic and we will make marks with coloring so color sensor can detect and show the display on the phone.



Road design

Project proposal 2- Protection Vest

Introduction

This article digs into the realm of IoT-enabled safety vests, examining the numerous benefits they provide and the unique functionality they bring to various industries. We will obtain a better grasp of how these vests improve safety, expedite operations, and contribute to a safer and more connected work environment by analyzing the key IoT technologies embedded into them.

Vest Design

Designing a protection safety vest with IoT capabilities necessitates considering both functional and aesthetic factors. Here are some things to think about when developing an effective and visually beautiful vest:

- Material with High Visibility: The fundamental function of a safety vest is to ensure visibility, particularly in dangerous areas. Choose a high-visibility material that meets safety requirements and laws, such as fluorescent or reflecting cloth. The material used should be long-lasting and resistant to wear and tear.
- Ergonomic Fit: The vest should be designed to give the wearer with a pleasant and ergonomic fit. Consider features like adjustable straps, breathable fabric, and lightweight construction to ensure comfort and longevity. It should allow for flexibility while still providing the required level of protection.
- IoT Sensor Integration: Incorporate IoT sensors into the vest's design in a way that does not hinder or interfere with the wearer's comfort or range of

motion. Consider strategic sensor placements, such as the chest for vital sign monitoring or the shoulder for fall detection.

- Wireless connectivity components, such as antennas or modules, should be integrated in a simplified manner. These components should fit seamlessly with the vest's design while maintaining dependable communication capabilities for data transfer and alarms.
- Enhancements to Visibility: Incorporate additional elements such as LED lights or illuminated strips to improve visibility. These can help with low-light visibility or provide visual cues for specific alerts or cautions.
- Customization and branding: Consider including the organization's logo, colors, or other branding features on the vest. This not only increases brand visibility, but also aids in employee identification and fosters a sense of unity.
- While practicality is important, attention to aesthetics can make the vest visually appealing. To achieve a professional and modern image, balance the use of contrasting colors, reflecting components, and design features.
- Compliance with Safety Standards: Make certain that the design complies with all applicable safety standards and regulations. Conduct extensive testing and certification methods to ensure the vest's effectiveness and compliance with industry standards.

By taking these design considerations into account, a protection safety vest with IoT capabilities can combine usefulness, comfort, and visual appeal, thereby improving safety and usage for individuals in numerous industries.

Requirement
Uno Arduino Board
Wheels
Battery
Bridge motor
Mini Breadboard
Vest
Camera
Jumper wires

Motion Sensor
Buzzer
Fire sensor
Gas sensor
GPS tracker

Protection vest

Project proposal 3: Animal smart bell

Collar Design

A smart collar for animals is designed to provide various functionalities beyond the traditional collar's basic purposes, such as identification and leash attachment. This smart collar typically incorporates electronic components and connectivity features, enabling them to gather data, track location, monitor health, and offer additional benefits for both pet owners and their furry companions.

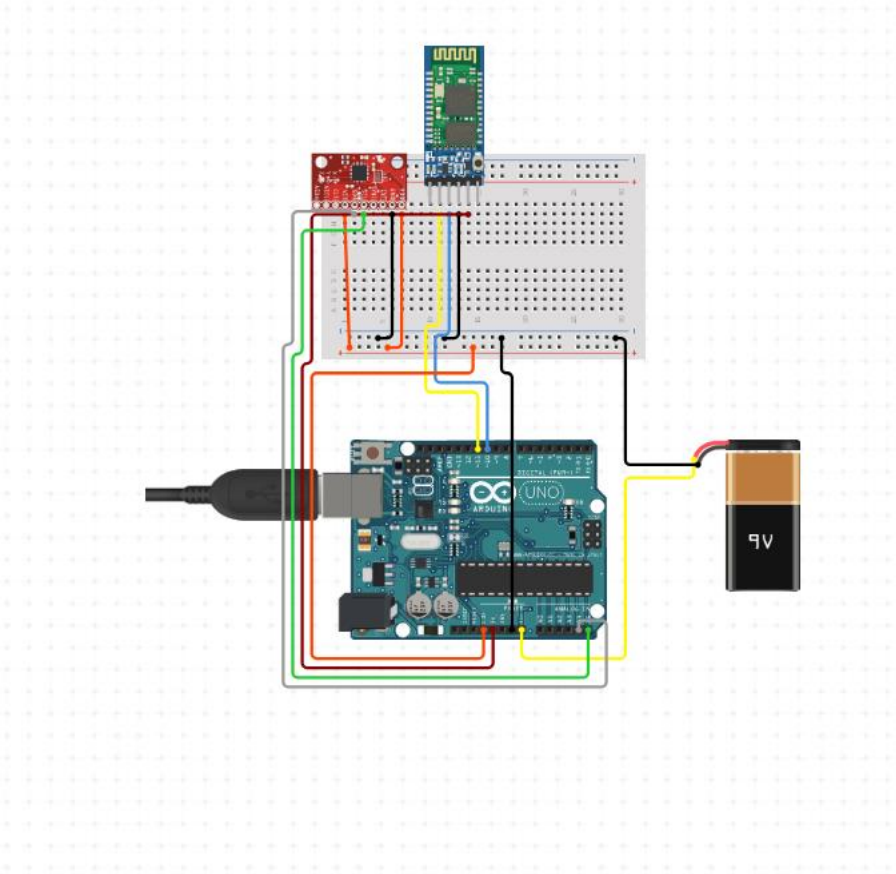
Requirement
Raspberry Pi Zero W
PICamera

Pulse sensor
Piezo
GY – 87
RGB LED
Battery
USB

Figure 1: Collar design

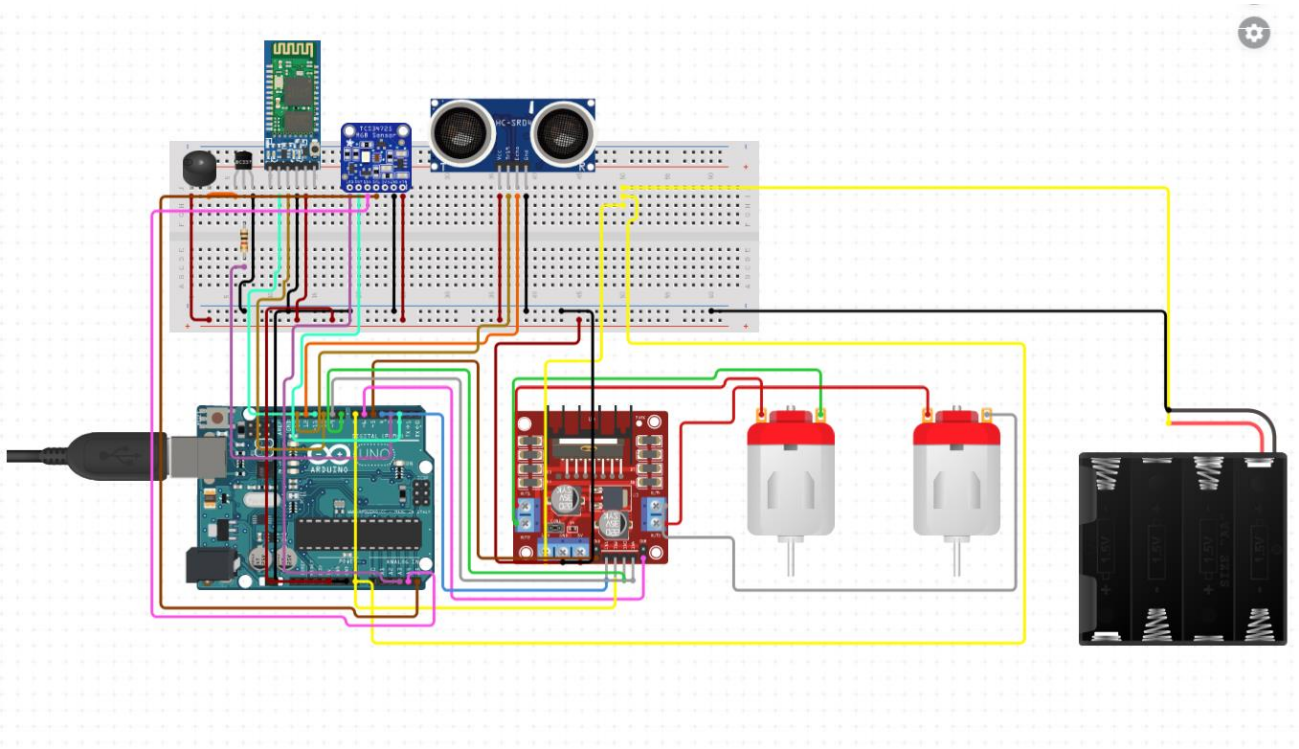
III. Review standard architecture, frameworks, tools, hardware and APIs for use in IoTs

Circuit Diagram



Gloves set up

This is the set up for gloves with transmitter and we use it WEMOSE D1 R2 MINI board but we cannot find that board when we draw thee circuit diagram so we use UNO board in the diagram but in our project, we use WEMOSE D1 R2 MINI board for both left and right gloves.



RC car set up

This is the set up of car connected with Bluetooth devices as receiver and our project include 2 cars and one of them used with WEMOSE D1 R2 MINI board and another one-use UNO board and as we mentioned for the gloves, we cannot find the board so we drew UNO board instead.

Standard architecture

- Gesture Acquisition: Gesture-Sensing Gloves: Gloves outfitted with sensors (flex sensors, accelerometers, and gyroscopes) to record hand motions and movements.
- Gesture Recognition: Microcontroller: A microcontroller embedded inside the gloves that analyses sensor data and extracts relevant hand gesture information.
- Gesture Recognition Algorithm: Uses machine learning or signal processing techniques to identify specific gestures based on extracted data.
- Bluetooth Communication: Bluetooth Module: Wirelessly transmits recognized gesture data to the RC car's control system.

- Microcontroller in the RC Car: Receives gesture data through Bluetooth and converts it into control commands for the RC car's movement.
- Motor Management: Motor Drivers: Controls the RC car's motors and actuators according on the orders received.
- Feedback and safety: Emergency Stop: A system that allows the automobile to stop moving in an emergency.
- Feedback Mechanism: Gives the user visible or audible feedback, validating acknowledged motions and activities.
- Power Control: Batteries: Power the gesture-sensing gloves as well as the RC car's control mechanism.
- Calibration Process: Allows users to calibrate the gloves for accurate gesture detection.
- Data Logging and study (Optional): Data Storage: Saves gesture data for study and optimization of gesture recognition algorithms.

Google Cloud Framework

Using Google Cloud as a foundation for your project has various advantages, including sophisticated cloud services, scalability, and simplicity of integration. However, it is critical to investigate alternative solutions based on the unique requirements of your project. Here's a look at some additional viable options:

Why Use Google Cloud:

- Extensive Services: Google Cloud offers a diverse set of services, including computation, storage, machine learning, and data analytics. This allows you to effortlessly develop, deploy, and manage your project components.
- Machine Learning and AI: Google Cloud provides sophisticated machine learning technologies like as TensorFlow and AutoML, which may be helpful for gesture detection and boosting your system's intelligence.
- IoT Integration: Google Cloud IoT Core enables simple integration and administration of IoT devices, making it ideal for IoT-based control applications.
- Scalability: The architecture of Google Cloud is built to accommodate projects of any scale. If you intend to extend your project or serve a big number of consumers, scalability is critical.

- Data Analytics: The data analytics capabilities provided by Google Cloud may assist you in gaining insights from gesture and usage data, allowing for ongoing development.
- Security: Google Cloud offers a variety of security solutions to keep your data and infrastructure safe.
- Google Cloud features excellent documentation and an active community, which makes it easy to get started, troubleshoot, and discover answers.

Other viable options include:

- Amazon Web Services (AWS): Advantages: AWS, like Google Cloud, provides a wide range of services, such as machine learning, IoT, and data analytics (Amazon, n.d.).
- Benefits of Microsoft Azure: Azure offers a full portfolio of cloud services and interacts nicely with Microsoft technologies. Azure's AI and IoT solutions can be beneficial (Microsoft, n.d.).
- IBM Cloud: Advantages: IBM Cloud provides a variety of AI, IoT, and analytics services, as well as cloud infrastructure (IBM, n.d.).

Hardware

Arduino boards

Asus tinker Board 2

The Asus Tinker Board 2 is a single-board computer (SBC) developed for Internet of Things (IoT) and other embedded applications, according to my most recent update in September 2021. It's an updated version of the original Asus Tinker Board, with better performance and functionality.

The following are possible Asus Tinker Board 2 features:

- Processor: The Tinker Board 2 has a more powerful processor, such as a quad-core ARM-based CPU, which provides greater processing capabilities appropriate for IoT and multimedia applications.
- RAM: It is likely to have a sufficient quantity of RAM, allowing for smooth multitasking and processing of various IoT-related tasks.

- Connectivity: In order to accommodate IoT applications, the Tinker Board 2 is slated to include Wi-Fi, Bluetooth, Ethernet, and USB interfaces, allowing it to communicate with other devices and the internet.
- GPIO (General Purpose Input/Output): GPIO pins are required for interacting with sensors, actuators, and other IoT peripherals.
- Storage: For storing the operating system and data, it may feature built-in storage choices such as eMMC or a microSD card slot.
- Operating System: The board may support many operating systems, such as Linux distributions such as Debian or Android, which are often used for IoT applications.
- Form Factor: The Asus Tinker Board 2 is likely to be tiny and designed to be easily integrated into a variety of projects and applications, as are most SBCs.
- As an Asus product, it may have a supporting community of developers and enthusiasts who provide useful materials, tutorials, and software support.

Odroid-C4

The ODROID-C4 is a single-board computer (SBC) created and manufactured by Hardkernel Co., Ltd. as of my most recent update in September 2021. It is intended for a variety of applications such as hobbyist projects, DIY electronics, educational reasons, and IoT (Internet of Things) projects. The ODROID-C4 provides a powerful and cost-effective computing solution in a small package.

The following are possible Asus Tinker Board 2 features:

- Processor: The Amlogic S905X3 system-on-a-chip (SoC) powers the ODROID-C4. It has a quad-core ARM Cortex-A55 CPU clocked at up to 2.0 GHz, which is a major jump in processing capability over the ODROID-C2.
- RAM: It normally includes 4GB of DDR4 RAM, allowing for efficient multitasking and handling of numerous apps and services.
- Connectivity: The board includes Gigabit Ethernet, built-in 2.4 GHz and 5 GHz Wi-Fi, and Bluetooth 5.0, allowing for flexible networking and wireless communication.
- GPIO (General Purpose Input/Output): The ODROID-C4, like most SBCs, has GPIO pins that allow users to communicate with external sensors, actuators, and electronic components for prototyping and bespoke projects.
- Video and graphics: The ODROID-C4 is equipped with a Mali-G31 MP2 GPU capable of handling graphics-intensive workloads and 4K video playback.
- Operating System: The board supports a variety of operating systems, including Ubuntu and Android, allowing for flexibility in meeting the needs of varied projects.
- Form Factor: The ODROID-C4 has a tiny form factor, similar to other SBCs, which makes it simple to integrate into projects and enclosures.
- As a member of the ODROID family, the ODROID-C4 has access to a vibrant and helpful community of developers and fans who provide essential information and software support.

Latte-panda 3 Delta

As of my most recent update in September 2021, there is no precise information about a product called "Latte-panda 3 Delta." It's possible that the product was

released or announced since my last update, or that it's a concept or project that hasn't received widespread attention.

However, based on LattePanda's naming convention, I can provide some broad information about their items.

LattePanda, like Raspberry Pi and other SBC makers, is recognized for developing single-board computers (SBCs) built for a variety of applications. Their SBCs, which are primarily based on Intel processors, provide a more robust computing experience than certain ARM-based SBCs.

The "Latte-panda" component of the name implies that it is most likely a LattePanda SBC. The "3 Delta" portion could refer to a version number or a specific model in their product line.

Seeed odyssey

The proper product name as of my final update in September 2021 is "Seeed Odyssey" (not "odyseey"). Seeed Studio, a well-known hardware producer in the maker and electronics communities, developed and produced the Seeed Odyssey, a high-performance single-board computer (SBC).

The Seeed Odyssey is intended for a variety of applications, including AI, machine learning, edge computing, and robotics. It is the result of a collaborative project with various industry partners, and it is a versatile and capable SBC for advanced projects.

The Seeed Odyssey may include the following key features:

- The Odyssey is driven by a powerful Intel processor, such as an Intel Apollo Lake series CPU, which provides enough computing capacity for AI and edge computing workloads.
- RAM: It usually comes with a good quantity of RAM, which allows for effective multitasking and processing of resource-intensive applications.
- Storage: The board often has onboard eMMC storage, which provides a dependable and quick storage option for the operating system and data.
- Connectivity: The Seeed Odyssey is most likely equipped with Gigabit Ethernet, USB ports, HDMI, and Wi-Fi, allowing for easy contact with other devices and the internet.
- AI Acceleration: One of the Seeed Odyssey's primary selling points is its AI acceleration capabilities, which make it appropriate for AI model inference and other machine learning activities.
- Expansion: The board will most likely include expansion options like as PCIe slots and GPIO headers, which will let users to connect extra peripherals and expansion boards to customize their projects.
- The Seeed Odyssey is designed to be tiny and fit into conventional enclosures, making it simple to integrate into a wide range of projects and applications.
- Operating System: The SBC supports a variety of operating systems, including Linux distributions like as Ubuntu and Windows, allowing for flexibility in meeting the needs of varied projects.

UD volt V8

The UDOO BOLT is a quantum leap forward in comparison to current maker boards: a portable, breakthrough supercomputer with a clock speed of up to 3.6

GHz thanks to the brand-new AMD RyzenTM Embedded V1000 SoC, a top-tier, multicore CPU with a mobile GPU on par with GTX 950M, and an integrated ArduinoTM-compatible platform all wrapped into one.

- AMD RyzenTM Embedded V1605B Quad Core/Eight Thread @ 2.0ghz (3.6ghz Boost) CPU
- Gpu Emmc 32gb Emmc 5.0 High Speed DriveGraphics Amd RadeonTM Vega 8 (8 Gpu Cu)
- Ram 2x Ddr4 Dual-channel 64-bit So-dimm Sockets With Ecc Support Up To 32gb 2400 Mt/s

Sensors

Fire Sensor

A "fire sensor" is a gadget that detects the presence of fire or smoke in its surroundings. It is essential in fire alarm systems and fire detection applications because it gives early warning of a potential fire, allowing for prompt response and evacuation (SURYATEJA, 2018).

There are numerous types of fire sensors, each using a different technology to detect distinct characteristics of a fire:

- Smoke Sensors (Smoke Detectors): These devices detect smoke particles in the air. Typically, they are based on photoelectric or ionization principles. Photoelectric smoke detectors detect smoke particles using a light source and a photosensitive receiver, whereas ionization smoke detectors employ a small quantity of radioactive material to ionize the air, allowing them to detect smoke particles via changes in electrical current (SURYATEJA, 2018).

- Heat Sensors (Heat Detectors): Heat sensors are used to detect temperature changes produced by a fire. They can be rate-of-rise heat detectors, which sound an alarm if the temperature rises quickly in a short period of time, or fixed temperature heat detectors, which sound an alarm when a specified temperature threshold is achieved (SURYATEJA, 2018).
- Flame Detectors (Flame Sensors): Flame detectors detect the presence of flames. They can detect the distinctive properties of flame radiation in the respective spectrum using infrared (IR) or ultraviolet (UV) sensing (SURYATEJA, 2018).
- Gas Sensors (Gas Detectors): Gas sensors are used in situations that may include combustible gases. They detect the presence of gases such as methane, propane, or hydrogen, which can indicate a possible fire threat (SURYATEJA, 2018).

Fire Sensor

Fire sensors are frequently integrated into fire alarm and smart home security systems. When the sensor detects fire or smoke, it activates the fire alarm or alerts the monitoring system, allowing occupants or authorities to take appropriate action to prevent fire spread and protect the safety of persons and property (SURYATEJA, 2018).

It is critical to maintain and test fire sensors on a regular basis to ensure appropriate performance. Furthermore, depending on the application and area, certain regulations and standards may restrict the use of fire sensors (SURYATEJA, 2018).

Water sensor

A "water sensor" is a gadget that detects the presence of water or moisture in its vicinity. It is widely utilized in a variety of applications to detect leaks, water damage, and water-related events. Water sensors play an important role in averting potential water-related incidents, such as floods or equipment breakdown, by detecting potential problems early and initiating relevant actions or alarms (MC, 2019).

There are several types of water sensors, each of which uses a different technology to detect water or moisture. Some examples of typical water sensors are:

- Contact Water Sensors: These sensors employ conductive materials that, when in contact with water, complete an electrical circuit. The circuit is closed when water is detected, and a signal is transmitted to trigger an alarm or other devices (MC, 2019).
- Capacitive Water Sensors: Capacitive water sensors detect moisture by measuring changes in capacitance produced by the presence of water. When there is water around, the capacitance of the sensor changes, resulting in a response (MC, 2019).
- Optical Water Sensors: Optical water sensors detect water using light-based processes. When water comes into touch with the sensor, it interferes with light transmission, resulting in a signal indicating the presence of water (MC, 2019).
- Ultrasonic Water Sensors: Ultrasonic water sensors send out sound waves and time how long it takes for the waves to return. When there is water present, the sound waves change, allowing the sensor to detect water (MC, 2019).
- Water Sensors Based on Absorption: These sensors use absorbent materials that change characteristics when exposed to water, resulting in a detecting signal (MC, 2019).

Water Sensor

Water sensors can be used in a variety of applications, including home security systems, water leak detection systems, automatic plant watering systems, weather monitoring stations, and industrial operations that need monitoring of water level (MC, 2019).

It is critical to choose the correct type of water sensor for the application and climatic circumstances. When employing water sensors in essential applications, frequent maintenance and calibration should be addressed to guarantee accurate and dependable operation (MC, 2019).

Motion Sensor

A motion sensor, also known as a motion detector or occupancy sensor, is a device that detects motion or movement in its surroundings. It is widely utilized in a variety of applications, including security systems, lighting control, home automation, and energy-saving solutions (2018-2023 ArduinoGetStearted.com, n.d.).

The following apps make extensive use of motion sensors:

- Security Systems: Motion sensors in security systems can activate alarms or inform the monitoring center when unlawful motion is detected, assisting in the prevention of break-ins and theft.
- Lighting Control: Motion sensors in lighting systems may switch on lights when motion is detected and turn them off after a predetermined time of

inactivity, conserving energy and increasing convenience (2018-2023 ArduinoGetStearted.com, n.d.).

- ❖ Home Automation: Motion sensors contribute to home automation by activating smart devices, altering temperature settings, and sending notifications depending on movement (2018-2023 ArduinoGetStearted.com, n.d.).
- ❖ Occupancy Sensing: In commercial buildings, motion sensors may detect room occupancy and change lighting, heating, or cooling systems accordingly, therefore optimizing energy use (2018-2023 ArduinoGetStearted.com, n.d.).
- ❖ Motion sensors are used in automated doors in supermarkets, airports, and other public locations to open the doors when someone approaches (2018-2023 ArduinoGetStearted.com, n.d.).

Motion Sensor

Motion sensors are meant to be efficient and sensitive enough to detect even little movements while being resistant to false triggers from non-human sources such as dogs or passing automobiles. They are widely accessible and utilized to improve safety, convenience, and energy efficiency in a variety of applications (2018-2023 ArduinoGetStearted.com, n.d.).

Color Sensor

A color sensor is a device that detects and classifies various colors in its environment. It can precisely assess the color of things by measuring the intensity and wavelengths of light reflected or emitted by them. Color sensors are widely utilized in a wide range of applications, including industrial automation, robotics, printing, quality control, and consumer electronics (savarJR, 2019).

There are numerous types of color sensors, each of which uses a different technology to measure and discriminate colors:

- RGB Color Sensors: RGB color sensors measure the intensity of light in each color channel by using red, green, and blue (RGB) filters. The sensor can detect the overall color of an item by integrating the intensity measurements of these three fundamental hues (savarJR, 2019).
- Color Photodiodes: Color photodiodes are light detectors that are sensitive to different wavelengths of light. They can detect the color of an item based on its spectral properties by measuring the intensity of certain hues (savarJR, 2019).
- Spectrophotometers: These are more sophisticated color sensors that can measure the complete spectrum of light reflected or emitted by an object. They are great for color matching and analysis since they can offer exact and comprehensive color information (savarJR, 2019).
- Filtered Color Sensors: Some color sensors include extra filters to target certain hues or color ranges, allowing them to be more specialized for specific purposes (savarJR, 2019).

Color sensors are necessary tools for applications requiring accurate color detection and analysis. They are available in a variety of form sizes and configurations, allowing customers to choose the best sensor for their unique requirements (savarJR, 2019).

Line follower sensor

A line follower sensor is a type of sensor that is widely used in robotics and automation to allow robots or vehicles to follow a predefined path or line. The contrast between the line and the surrounding surface is detected by the sensor, allowing the robot to modify its movement and stay on the specified path (lightthedreams, 2020).

The infrared (IR) sensor is the most popular form of line follower sensor. It is made up of an infrared transmitter (LED) and an infrared receiver (photodiode). The IR transmitter sends infrared light onto the surface, and the IR receiver measures the quantity of light that is reflected. The amount of reflected light is

dramatically different when the sensor is over the line vs when it is over the background surface. The robot can tell whether it is on or off the line by comparing the reflected light levels and adjusting its motions appropriately (lightthedreams, 2020).

Multiple sensors are often organized in a line in line follower sensors, allowing the robot to determine the location of the line relative to its center. The robot can decide how to steer and maintain its route by comparing sensor readings (lightthedreams, 2020).

The functioning concept of line follower sensors is as follows:

1. When the robot is on the track, the sensors detect high quantities of reflected light (for example, on a white surface), indicating that it is on the track (lightthedreams, 2020).
2. When the robot deviates from the path, the sensors detect low reflected light levels (e.g., a black line or a darker surface), signaling that it needs to modify its trajectory to return to the path (lightthedreams, 2020).

Line Follower Sensor

Sound Sensor

A sound sensor, also known as a sound detector or sound module, is a device that detects and measures the intensity of sound in its surroundings. It transforms sound waves into electrical impulses, allowing for additional processing or action triggering based on the strength or frequency of the sound (WatElectronics, 2022).

Audio processing, noise monitoring, home automation, robotics, and security systems are all prominent uses for sound sensors. They are critical components in projects that involve contact with sound or the acoustic properties of the surroundings (WatElectronics, 2022).

There are numerous types of sound sensors, each of which uses a different technology to detect sound:

- Microphones: Transducers that transform sound waves into electrical impulses are known as microphones. Condenser microphones, dynamic microphones, and MEMS (Micro-Electro-Mechanical Systems) microphones are among the several varieties. Each kind has unique properties, sensitivity, and frequency response (WatElectronics, 2022).
- Sound Detection Modules: These are pre-assembled modules that combine a microphone or a sound sensor with extra electronics to give a simple sound detection interface. They frequently have adjustable sensitivity as well as output signals that are easily integrated with microcontrollers or another circuitry (WatElectronics, 2022).
- Piezoelectric Sensors: When exposed to vibrations, including sound waves, piezoelectric sensors create electrical signals. They can be used to detect sound in specific frequency bands or for applications requiring a robust and small sensor architecture (WatElectronics, 2022).
- MEMS Sound Sensors: MEMS-based sound sensors are compact, highly integrated devices that merge the microphone and supporting circuitry into a single chip. They're popular in smartphones, voice assistants, and other portable gadgets (WatElectronics, 2022).

Sound Sensor

Individual components, sound detecting modules, and integrated circuits are all common kinds of sound sensors. They are simple to include into electrical projects and systems in order to enhance sound detecting capabilities (WatElectronics, 2022).

Bridge Motor Driver

A bridge motor driver, also known as an H-bridge motor driver, is an electronic circuit that controls the speed and direction of a direct current (DC) motor. It is made up of four switches that may be adjusted to change the direction of current flow through the motor, enabling it to travel forward or backward and control its speed (Subedi, 2023).

An H-bridge configuration's four switches are often implemented using transistors (commonly MOSFETs or bipolar transistors) or semiconductor devices such as H-bridge motor driver integrated circuits (ICs). The configuration of these switches is similar to the letter "H," thus the name "H-bridge." (Subedi, 2023).

A bridge motor driver's fundamental operation entails the following:

- Motor Direction Control: The current may be routed through the motor in either direction by activating the right set of switches. When one set of switches is closed and the other is open, electricity travels from the power source to the motor in just one direction, causing it to revolve. The current flows in the other direction when the switch states are reversed, causing the motor to revolve in the opposite direction (Subedi, 2023).
- Speed adjust: A method known as Pulse Width Modulation (PWM) is commonly used to adjust the speed of the motor. The effective voltage across the motor is changed by rapidly switching the switches on and off with various duty cycles. A greater duty cycle leads in a higher average voltage, which increases the speed of the motor, and vice versa (Subedi, 2023).

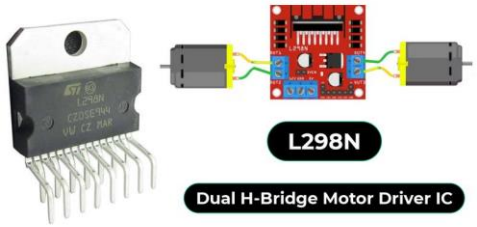


Figure: 3.6 Bridge motor driver

Bridge motor drivers are often employed in robotics, electric cars, industrial automation, and consumer electronics. They offer a simple and economical method of controlling DC motors with varied power needs and rotating orientations (Subedi, 2023).

Bi-directional control, efficient energy transfer to the motor, and the possibility to apply numerous control algorithms for accurate motor speed and torque control are all advantages of employing a bridge motor driver (Subedi, 2023).

Bridge motor drivers come in a variety of configurations, ranging from simple discrete transistor-based H-bridge circuits to more complex and high-performance motor driver ICs with extra protective features. The proper bridge motor driver is determined by parameters such as the voltage and current ratings of the motor, the needed control features, and the unique demands of the application (Subedi, 2023).

MPU 6050 accelerometer sensor

The MPU-6050 is a well-known and commonly used motion tracking device that integrates a 3-axis accelerometer and a 3-axis gyroscope into a single chip. It is widely used in robotics, drones, gaming, motion-controlled devices, and inertial measurement units (IMUs) for motion sensing and tracking (RucksikaaR, 2021).

The following are the key characteristics and functionalities of the MPU-6050 accelerometer sensor:

- The MPU-6050 has a 3-axis accelerometer that can measure accelerations along the X, Y, and Z axes. It can detect changes in orientation, tilt, and linear acceleration and delivers accurate data regarding the device's linear motion (RucksikaaR, 2021).

- The MPU-6050 has a 3-axis gyroscope in addition to the accelerometer. The angular rate of rotation around the X, Y, and Z axes is measured by the gyroscope. It detects rotational motions including tilt, rotation, and angular velocity (RucksikaaR, 2021).
- Six Degrees of Freedom (6-DOF): The MPU-6050 has six degrees of freedom (6-DOF) thanks to the combination of the accelerometer and gyroscope, allowing it to monitor motion in three-dimensional space (RucksikaaR, 2021).
- The MPU-6050 connects with microcontrollers or other devices using a standard I2C (Inter-Integrated Circuit) digital interface, making it simple to interface with a variety of microcontrollers and development boards (RucksikaaR, 2021).
- Data Output: The accelerometer and gyroscope sensors give real-time data readings, allowing developers to access accurate motion data for their applications (RucksikaaR, 2021).
- Digital Motion Processing (DMP): The MPU-6050 incorporates DMP capabilities, which offloads some motion processing chores to the processor itself. This functionality can reduce the processing burden on the microcontroller linked (RucksikaaR, 2021).
- Temperature Sensor: The MPU-6050 includes an on-chip temperature sensor that may provide data on the sensor's operating temperature (RucksikaaR, 2021).

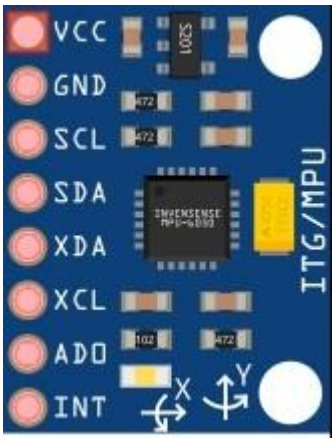


Figure 3.7: MPU 6050 Accelerometer Sensor

Developers commonly attach the MPU-6050 accelerometer sensor to a microcontroller or development board, read the sensor's data through I2C connection, then analyze the motion data to integrate different motion-related functionalities in their applications. There are multiple online libraries and tools that assist interfacing with the MPU-6050 sensor on various platforms and computer languages (RucksikaaR, 2021).

IV. Current problems

Risk problems

Fire responder communication:

Effective communication among first responders is critical in the pandemonium of disaster scenes or dangerous conditions. Gesture-controlled technology can provide responders with a smooth and intuitive approach to transmit essential information and coordinate actions.

Benefits:

- Hands-Free Interaction: Gesture-controlled gadgets enable first responders to interact without using their hands, allowing them to complete important activities while remaining connected.
- Noise Reduction: When standard communication methods fail in loud circumstances, gesture-controlled communication provides a viable alternative.
- Efficiency: By using familiar gestures, responders may swiftly express directions and information, speeding collaboration and eliminating delays.
- Minimal Distraction: Gesture communication eliminates the need for responses to redirect attention away from vital operations.
- Gesture-controlled technology improves the efficacy and safety of rescue operations in each of these situations. This technology enables rescue teams to traverse barriers and save lives more effectively than ever before by giving remote control capabilities in difficult locations and promoting seamless communication among rescuers.

Accessible Disaster Relief:

Gesture-controlled technology has the potential to improve disaster relief operations by making them more accessible and inclusive, particularly for people with restricted mobility or impairments. This technology can allow persons to engage in relief activities and effectively convey their requirements by providing an intuitive and hands-free means of involvement.

Benefits:

Inclusive Participation: Gesture-controlled technologies allow those with mobility issues to actively participate in disaster relief activities. They can use gestures to control equipment, open doors, and signal for help without depending on physical dexterity.

Efficient Communication: When traditional communication techniques are disrupted during a crisis, gesture-based communication provides an option that does not require spoken language or fine motor abilities. This is especially useful for people who struggle with communicating.

Gesture-controlled gadgets can be utilized to operate robotic devices or vehicles deployed in disaster-stricken areas. Individuals who are unable to physically engage in search, rescue, and recovery efforts can now do so.

User-Friendly: Because gesture interactions are natural and straightforward, they are accessible even to persons who are unfamiliar with complicated technological interfaces. This lowers the obstacles to involvement for people of all ages and backgrounds.

Gesture-controlled gadgets provide speedy exchange of distress signals or calls for assistance, allowing relief teams to respond quickly and reducing reaction time in crucial situations.

Environmental problems

Gesture control may be a driving factor for sustainable practices in a variety of businesses. From energy-efficient home automation to improved industrial operations, technology enables people to make educated decisions that minimize

energy consumption, encourage environmentally friendly living, and contribute to a greener future.

Safety Applications:

Gesture control technology shines as a flexible instrument in the field of safety. It allows healthcare providers to interface with medical devices while maintaining cleanliness. It provides a better approach to handle equipment in hazardous locations, improves vehicle safety, and supplements safety measures in a variety of industries.

Rescue Field Applications: Perhaps most notably, gesture control appears as a lifeline in rescue operations. It enables search and rescue drones to travel hazardous terrain and find missing people. The technology alters disaster response by allowing remote investigation in dangerous locations, making disaster relief options more accessible, and improving communication among first responders.

V. How to Solve with IoTs and benefits

Gesture Gloves

Item	Quantity
WE MOSE D1	3
ARDUINO UNO	1
Bluetooth sensor	4
Motor Bridge Driver	2
Gloves	1
Car motors	4
MPU 6050 Accelerometer Sensor	2
Wheels	4
Buzzer	1
Jumper Cable	

Gloves

WEMOS D1 R2 Mini Board

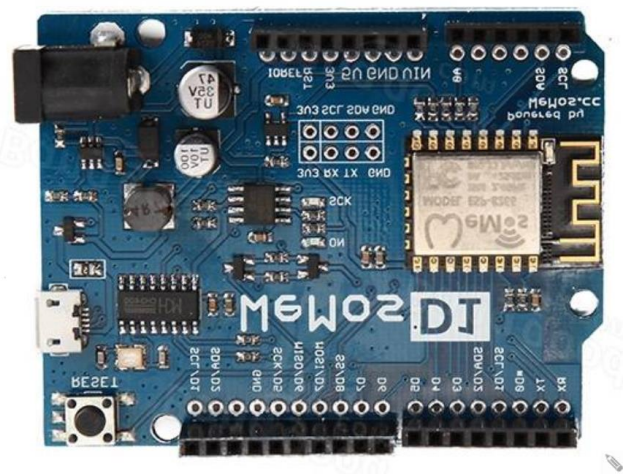
The WEMOS D1 R2 Mini is a small development board based on the ESP8266 microcontroller, which is popular in Internet of Things (IoT) applications due to its low cost, built-in Wi-Fi capabilities, and ease of use. When used with RC vehicles, the WEMOS D1 R2 Mini acts as the brain or controller for the gloves, allowing them to connect wirelessly with the RC car and control its motions via hand gestures.

Here are some of the reasons why the WEMOS D1 R2 Mini is a good fit for this application:

- Wi-Fi connection: The ESP8266-based WEMOS D1 R2 Mini includes built-in Wi-Fi connection, allowing the gloves to interact wirelessly with the RC car. This implies that no extra modules are required to make a wireless connection.
- modest Size: Because the WEMOS D1 R2 Mini is modest in size, it can be easily integrated into hand gesture gloves without adding any thickness or weight to the design.
- Low Power Consumption: The ESP8266 microcontroller is intended to be power-efficient, which is critical for wearable applications such as hand gesture gloves. You don't want the gloves' charge to run out rapidly while wearing them.
- Sensor Integration with GPIO Pins: The WEMOS D1 R2 Mini has General Purpose Input/Output (GPIO) pins that may be utilized to interact with sensors on the gloves. These sensors detect hand gestures or movements, which the microcontroller processes and converts into control impulses for the RC car.
- Cost-Effectiveness: The WEMOS D1 R2 Mini is quite affordable, which is advantageous if you intend to make numerous pairs of hand gesture gloves or if your project has a limited budget.

You may build a fun and interactive method to control the motions of RC vehicles by utilizing the WEMOS D1 R2 Mini in hand gesture gloves. The gloves can detect

and interpret numerous hand movements, such as moving your hand up, down, left, or right, into precise orders for the RC vehicle to obey, resulting in an intuitive and entertaining user experience.



MPU 6050

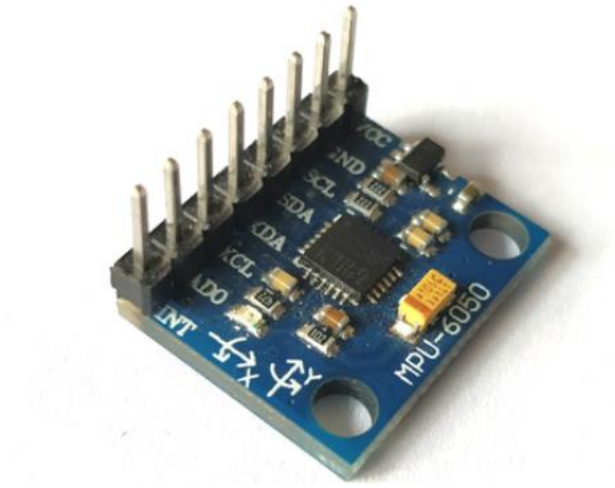
Using an MPU 6050 (Motion Processing Unit) with hand gesture gloves to control RC cars has various advantages. The MPU 6050 is a well-known and commonly used sensor module that combines a gyroscope and an accelerometer to precisely monitor motion and direction. Here are some of the benefits of using hand gesture gloves with RC cars:

- Capabilities for Motion Sensing: The MPU 6050 can recognize numerous hand gestures and movements such as tilting, spinning, and shaking. These movements may be assigned to particular commands for operating the RC car, resulting in a more natural and immersive control experience.
- accurate Control: The MPU 6050 delivers real-time data on the motion of the glove, enabling for accurate and responsive RC car control. This degree of precision guarantees that the automobile responds to the user's movements correctly, improving the entire driving experience.
- Compact and lightweight: The MPU 6050 is a small and light sensor module that may be included into hand gesture gloves without adding much bulk or weight. This enables for a glove that is both comfortable and inconspicuous.
- Wireless Communication: The MPU 6050 may connect wirelessly with the RC car's control system by interacting with microcontrollers or other

processing units. This eliminates the need for physical connections between the glove and the automobile, allowing the user to move freely.

- Gesture Customization: The MPU 6050 allows you to program and configure individual motions for the RC car's many functionalities. Tilting the hand forward, for example, may cause the automobile to speed, while tilting it backward may cause it to brake or reverse. This customization increases the glove's control scheme's versatility and adaptability.
- Hand gesture gloves used to control an RC vehicle may be a pleasant and accessible method for individuals of all ages and skill levels to engage with the car. It may also be appealing to individuals who find standard remote controls difficult to operate.

In conclusion, the MPU 6050 is a flexible motion sensor that may be efficiently integrated into hand gesture gloves to drive remote controlled autos. Its motion detecting capabilities, accurate control, and customization choices make it a fantastic choice for creating a fun and engaging driving experience.



Bluetooth Module HC05

Using an HC-05 Bluetooth module in hand gesture gloves with RC vehicles provides various benefits and functions that improve the user experience and RC car handling. The HC-05 Bluetooth module is a common choice for such applications for the following reasons:

- ❖ Simple to set up and use: The HC-05 module is simple to set up and use, making it suitable for amateurs and DIY enthusiasts who wish to build their own gesture-controlled RC vehicles.
- ❖ Bluetooth technology ensures a solid and dependable connection between the gloves and the remote-control automobile. This guarantees that the user's orders and gestures are correctly sent to the automobile for seamless operation.
- ❖ Cost-effective: The HC-05 Bluetooth module is a low-cost solution for adding Bluetooth functionality to hand gesture gloves, making it an appealing option for low-budget projects.
- ❖ The HC-05 module is extensively supported and interoperable with a broad range of devices, including smartphones, tablets, and PCs. This enables the incorporation of additional control interfaces, such as utilizing a smartphone app to drive the RC car.
- ❖ Customizability: The HC-05 module may be readily incorporated into various projects and configured to meet individual needs. This adaptability enables users to adjust the hand gesture control system to their specific tastes and requirements.

Because of its wireless capabilities, ease of usage, low power consumption, and low cost, the HC-05 Bluetooth module is a popular and adaptable choice for hand gesture gloves with RC vehicles. It allows users to drive their RC vehicles with intuitive gestures, bringing a fun and innovative addition to the classic remote-control experience.

RC Cars

Other equipment- WEMOS D1 R2 Mini (same as gloves) and Bluetooth Module HC-05 (same as gloves)

Bridge Motor Driver

Using a bridge motor driver in hand gesture gloves with RC vehicles can give a number of advantages and features for operating the vehicle. A bridge motor driver is a motor driver circuit that permits bidirectional control of motors, which means it can control the rotation of the motor in both directions (forward and backward). Here's why it's useful in RC vehicle hand gesture gloves:

- Bridge motor drivers may change the direction of rotation of the motor, letting the RC vehicle to travel forward and backward. This is necessary for efficiently directing the car's movement with hand gestures.
- Bridge motor drivers often provide fine-grained speed control. You can properly change the car's speed by adjusting the voltage provided to the motor, providing smooth and precise movement in reaction to hand gestures.
- Regenerative braking is supported by some sophisticated bridge motor drivers. When you use hand gestures to slow or stop the automobile, the motor driver can convert the kinetic energy of the moving car back into electrical energy and store it for later use. This can increase energy efficiency and battery life.
- Bridge motor drivers frequently have built-in safety measures like as overcurrent protection and thermal shutdown. In the event of a problem or a motor stall, these characteristics can assist safeguard the motor and the driver circuit from damage.
- Microcontroller compatibility: Bridge motor drivers can readily interact with microcontrollers or other control systems. Microcontrollers are frequently used in hand gesture gloves for RC vehicles to interpret the gestures and provide suitable control signals for the motor driver.

Overall, the bidirectional control, accurate speed control, regenerative braking, safety features, and compatibility with microcontrollers of the bridge motor driver

make it a good choice for building hand gesture gloves to operate RC vehicles effectively and intuitively.

DC motor

- DC motors are very basic technologies, making them cost-effective and straightforward to include into the design of hand gesture gloves. They are readily accessible and come in a variety of sizes and power levels to meet the needs of the RC car.
- Controllability: DC motors are highly controllable, allowing users to change the speed and direction of the RC car with hand gestures. This feature makes the interaction more straightforward and user-friendly, which is especially beneficial for novices.
- Response Time: DC motors often have fast response times, allowing the RC car to respond quickly to the user's motions. This responsiveness improves the entire control experience of the RC car.
- Battery Efficiency: Depending on the design and application, DC motors can be more energy efficient than other types of motors. This feature can increase the RC car's battery life, allowing for more gameplay before recharging.
- Customization: Because DC motors are easily adaptable to unique design needs, they are suitable for a wide range of RC vehicle types and hand gesture glove designs.

Other types of motors, such as brushless DC motors or servo motors, can also be utilized in hand gesture gloves with RC vehicles, depending on the unique

application needs and design concerns. Each motor type has benefits and disadvantages; therefore, the decision is determined by considerations such as cost, performance, power efficiency, and the complexity of the control system.

Advantage of project

- Hands-Free Control: Hand gesture control allows users to drive the RC car without using physical buttons or joysticks, allowing for a hands-free experience. This is especially handy when users need to free up their hands for other chores or operations.
- Hand gesture control can provide a more immersive experience for users by allowing them to feel a stronger connection with the RC car by steering, accelerating, and stopping it with their hands.
- Hand gesture gloves are often tiny and portable, allowing users to drive the RC car without having to carry large remote devices. This mobility might be useful in outdoor settings or when traveling.
- Hand gesture control systems may be created with the flexibility to modify and map certain movements to different tasks, allowing users to select their preferred control gestures.
- Educational Value: This project may be used to expose students and hobbyists interested in electronics and robotics to concepts like as gesture recognition, sensor integration, and motor control.

Disadvantage of the project

- Gesture Recognition Complexity: Developing an accurate and dependable gesture recognition system may be difficult. To effectively understand hand movements, advanced algorithms and sensor integration are required. False positives or misinterpretations may result in unintentional control of the RC car, perhaps resulting in accidents or annoyance for the user.
- Users' Learning Curve: Mastering gestures and comprehending the proper movements for certain instructions may take some time and effort. It may be less intuitive or convenient for users to use typical controllers such as buttons or joysticks.
- Battery Consumption: Using gesture detection and motor control technologies might raise the total power consumption of the setup. This may result in reduced battery life for both the hand gesture gloves and the RC car.
- Integrating the necessary sensors and control modules into the gloves and RC vehicle might increase size and weight, potentially making the gloves less pleasant to wear and impairing the RC car's performance.

Functions of this project

Hand gestures controlling an automobile in a racing project can give an intuitive and engaging approach for the driver to manage many components of the vehicle without depending on traditional physical controls such as a steering wheel or pedals. Hand gestures may improve the racing experience by making it more immersive and perhaps faster.

Here's an example of how hand gesture control may be used in a racing vehicle project:

- Gesture Recognition: To effectively monitor the driver's hand motions and gestures, the automobile would be outfitted with sensors, cameras, or depth-sensing technology (such as infrared cameras or LIDAR). In real time, these sensors record the driver's hand placements and gestures.
- Calibration and Personalization: Before utilizing the gesture control system, the driver may need to undertake a calibration step to guarantee that the

system detects their hand motions properly. This technique may require the driver to make precise motions in order to create a baseline for recognition.

- Safety Measures: A critical part of any racing project is safety. To prevent undesired actions, the gesture control system should have fail-safe techniques. Accidental gestures or misinterpretations, for example, should not result in hasty and risky moves.
- Indicators and feedback: The system should offer visual or audible feedback to the driver indicating that a gesture has been identified and what action it relates to. This input can assist the driver in remaining informed and avoiding misunderstanding.
- Fallback method: While gesture control can be exciting and novel, it is critical to have a fallback method in place in case the driver has difficulty using the gestures or the system fails. As a backup, traditional controls such as a steering wheel and pedals may still be accessible.
- Customizability: Different drivers may prefer different gesture mappings or require adaptations due to their driving style or physical restrictions. Providing users with the opportunity to adjust gesture mappings can increase usability and accessibility.
- Integration with Other Systems: The hand gesture control system must be flawlessly connected with the vehicle's overall control system, which includes the engine, gearbox, brakes, and any other features such as adaptive suspension or aerodynamics.
- Training and Familiarization: For drivers who are unfamiliar with the gesture control system, it is critical to provide training and familiarization sessions so that they can use and profit from the technology successfully. Hand gesture control in a racing project is an intriguing notion that may provide drivers with a futuristic and exciting experience. However, when investigating such cutting-edge technology, it is critical to consider safety and usefulness.

Budget

- Prioritization and Scope: We went over the project scope again, identifying key features and components. We could manage resources more efficiently and minimize superfluous expenditures if we focused on essential features.
- Cost Analysis: By doing a thorough cost analysis, we were able to find areas where we might save money without sacrificing quality. We examined both direct and indirect expenses, looking for possible cost-cutting options.

Coding

- Problem Identification: The first step was to fully comprehend the code issue. We examined the problem to see where our code was failing or not giving the expected results.
- Underlying Cause Analysis: To uncover the underlying causes of the coding problem, we performed a detailed investigation. This entailed studying the coding, reading pertinent documentation, and finding any inconsistencies or flaws that may have caused the problem.
- We encouraged free communication and collaboration among team members. Each person provided a distinct viewpoint to the subject, giving ideas that helped develop a thorough grasp of the challenge.
- Testing and Debugging: Thorough testing was essential in detecting problems and vulnerabilities in the code. We traced the flow of the software and identified places that needed to be corrected using different debugging tools, breakpoints, and logging methods.
- Refactoring: In certain situations, we discovered that the current code structure needed to be improved in order to remedy the issue. We worked on code restructuring, reorganization, and optimization to make the codebase more modular, legible, and efficient.
- When confronted with extremely complicated or unfamiliar issues, we consulted appropriate resources such as internet forums, manuals, or colleagues with experience in the specific programming languages or technology involved.
- Iterative technique: To solve the challenge, we used an iterative technique. We tackled one problem at a time, tested the adjustments, and steadily

built on our success. This method assisted us in avoiding the introduction of new defects while correcting old ones.

- Version Control: Using version control systems like Git allowed us to log changes, communicate smoothly, and rollback to prior states if necessary, protecting our work while we solved the coding challenge.
- Documentation: We kept extensive records of the problem, its analysis, the methods taken to remedy it, and the outcomes throughout the process. This documentation will be useful for future reference and for sharing thoughts with team members.
- Validation and Testing: Following the implementation of solutions, we did extensive testing to ensure that the code issue had been effectively rectified. This entailed conducting a number of test cases, simulations, and scenarios to check that the system's functionality was restored.
- We conducted peer code reviews before completing the solution. Colleagues assessed the modifications made to guarantee code quality, best practices adherence, and to spot any potential oversights.
- Even after we solved the immediate coding issue, we developed monitoring methods to track the system's performance over time. This proactive strategy assists us in identifying any potential relapse or new concerns.

VI. Timetable & Budget

Total Budget					
Items	Qty	Order Date	Arrival Date	Total Budget	Member Budget
MPU 6050 Accelerometer sensor	2	July 17,2023	July 18,2023	10000	2000
Bridge motor driver	2	July 17,2023	July 18,2023	11000	2200
WEMOSE D1 Arduino Board	4	July 17,2023	July 18,2023	58000	11600
Jumper Cable	3	July 17,2023	July 18,2023	6000	1200
Mini Breadboard	4	July 17,2023	July 18,2023	8000	1600
DC motor Cars	2	July 21,2023	July 22,2023	32700	6,540
Gloves	1	7-Aug-23	7-Aug-23	18000	3600
Bluetooth	4	July 25,2023	July 21,2023	50000	9800
Accidental Items	2	31-Jul-23	1-Aug-23	34,700	6,900
Decoration Requirements	5	7-Aug-23	7-Aug-23	25000	5000
Wheels	4	7-Aug-23	7-Aug-23	8000	1600
Total				261400	52,040

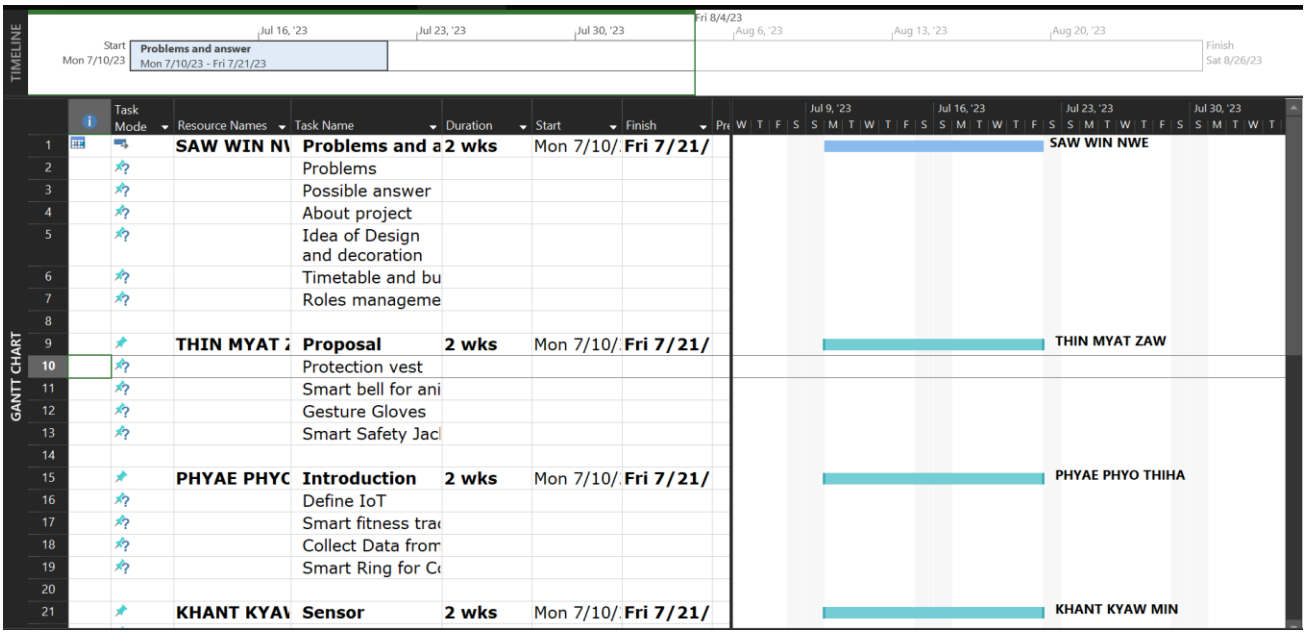
Writing Report					
Member Roles	**Responsibility**	**Duration**	**Start Day**	**End day**	**Complete yes/no**
SAI AUNG HSO MUNG	**Arduino Boards** Asus tinker Board 2 Odroid-C4 Latte-panda 3 Delta SEEED odyssey UD volt V8 Smart Glasses for Augmented Reality (AR)	2 Weeks	10/7/2023	21/07/2023	Yes
KHANT KYAW MIN	**Sensor** Fire Sensor Water Sensor Motion Sensor Color Sensor Line follower sensor Sound Sensor Smart Ring for Contactless Payments Bridge Motor Driver MPU 6050 accelerometer sensor	2 Weeks	10/7/2023	21/07/2023	Yes
	Proposal				Yes

THIN MYAT ZAW	Protection vest Smart bell for animal Gesture Gloves Smart Safety Jacket	2 Weeks	10/7/2023	21/07/2023	
PHYAE PHYO THIHA	**Introduction** Define IoT Smart fitness tracker Collect Data from members and abject Smart Ring for Contactless Payments	2 Weeks	10/7/2023	21/07/2023	Yes
SAW WIN NWE	**Problems and answer** Problems Possible answer About project Idea of Design and decoration Timetable and budget Roles management	2 Weeks	10/7/2023	21/07/2023	Yes

Design						
Design	Started date	Member	Duration	Process	Task	Complete yes/no
Car Design	22 July, 2023	All	1 day	1 car set up	1 car set up	yes
Car Coding	22 July, 2023	SAW WIN NWE & THIN MYAT ZAW	1 day	Code Testing and Running	Testing	yes
Gloves Design	23 July, 2023	All	1 day	1 glove set up	1 glove set up	yes
Gloves Coding	23 July, 2023	SAW WIN NWE & PHYAE PHYO THIHA	1 day	Code Testing and Running	Testing	Yes
Road Decoration	8 August, 2023	SAI AUNG HSO MUNG & KHANT KYAW MIN	2 days	Buy requirement and design decoration for the project	Decent decoration	Yes

Meetings					
Date	Attendance	Absent	About	Duration	Problem
20/07/2023	All	Non	budget and project preparation	1 hour and 30min	none
31/07/2023	All	Non	Ordering requirements	1hour	none
8/8/2023	All	Non	Design discussion	2 hours	Different opinion
12/8/2023	All	Non	Installation meeting	4 hours	Researching
20/8/23	All	Non	Finishing Up	3 hours	none

Timeframe



VII. Run end user experiments and examine feedback.

User Name	Rating	Feedbacks	Suggestions
MS. MYAT HMONE NATHAR Educator	5/5	Normally, vehicles like the one in this project require the use of a phone or remote control, but now I can operate it using only my hand. As I move my hand, the gloves detect the motion and cause the vehicle to drive ahead or backward, which is so fascinating and thrilling for me to use.	If you can handle a larger budget and include more features like as a camera and voice recommendation, among other things, I feel the project will be much better and more useful to people.
Anonymous	4/5	Project is creative and innovative to use.	Project will be better if you put, location tracker route history, driving mood and speed, choosing feature, fire prove deign cover.
Dr. MYO MYINT OO	5/5	The vehicle sleek appearance and high-quality construction amazed me. It's	Same the MS. MYAT HMONE NATHAR, you should add voice

		apparent that the makers put in time and effort to create a premium-feeling product. Setting up the Bluetooth connection was surprisingly simple; the included instructions walked me through the steps, and I was up and running in no time.	recommendation and camera.
Teacher THITHITHANDER	4/5	I was able to tailor the driving experience to my preferences, making it suited for both relaxed play and more severe racing challenges.	Adding sound sensor linked with ultrasonic sensor will be better. If the vehicle detects the object that block the way, the sound sensor will alarm the user to back up.

VIII. Evaluation of IoT application and detail the problem of IoT application solves, the potential impact on people, business, society and the end user and the problems it might encounter when integrating into the wider IoT ecosystem

The potential impact on people, business, society and the end user

- User Experience Enhancement: The hand gesture-controlled Bluetooth RC car presents a fresh and intuitive method of interacting with technology. This can increase user delight by giving a distinctive and interesting experience.
- Accessibility: The project can help people with physical limitations manage their RC cars more easily. It encourages inclusion and accessibility in the use of technology.

Society impact

- Human-Machine Interaction: This project demonstrates how technology may be smoothly integrated into ordinary human activities, making technology more natural and intuitive to use.
- Safety and Efficiency: The gesture control system can help to safety and efficiency in particular circumstances, such as running the RC car in dangerous places or controlling it with both hands occupied.
- Entertainment and leisure: By incorporating interaction and personalization into remote control experiences, the initiative adds a new level to entertainment and leisure.

Integration into a Larger IoT Ecosystem

Integrating the hand gesture Bluetooth control RC car with the larger IoT network allows for:

- Interoperability: Integration with other IoT devices and platforms may allow for coordinated activities with other smart devices, improving automation and control.

- Remote Control and Monitoring: Using IoT platforms for remote control and monitoring of the RC car can increase its usefulness and generate data insights.
- Data Analysis: Gathering gesture data might help with data analytics and user behavior insights, potentially leading to better gesture recognition models.

IX. Summary

The Hand Gesture Bluetooth Control RC Car IoT project makes use of cutting-edge technology to provide an engaging and intuitive remote-control experience. This project provides a novel approach to drive an RC car by combining gesture detection, Bluetooth connection, and IoT principles. Hand gestures allow users to direct the car's motions, improving the user experience, accessibility, and engagement.

Finally, the gesture-controlled toy vehicle concept goes beyond enjoyment to encompass a wide range of applications with far-reaching good consequences. It demonstrates how technology can stimulate creativity, improve sustainability, and save lives. Gesture control technology exemplifies the revolutionary potential of innovation by encouraging environmentally friendly habits, assuring safety in a variety of contexts, and playing an important part in rescue operations. It demonstrates how a single effort may help to make the world a safer, more sustainable, more technologically sophisticated place.

To summarize, the influence of gesture-controlled technology in rescue operations includes underwater exploration and communication among first responders. These applications demonstrate how creative solutions may improve the safety, efficiency, and overall success of rescue missions in high-stress and dangerous situations.

Accessible disaster assistance is an important use of gesture-controlled technology, allowing those with mobility issues to participate actively in times of need. This technology enables people to communicate efficiently, request help, and even engage in rescue operations remotely, encouraging a more inclusive and humane approach to disaster response.

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