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INTELLIGENT IOT-DRIVEN AUTONOMOUS VEHICLE WITH EMBEDDED C : A SMART MOBILITY SYSTEM

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• INTRODUCTION:

Autonomous vehicles (AVs) and associated technologies have rapidly gained the attention of the research community. AV utilizes sensorial technologies such as computer vision, odometry, GPS, laser lights, sensors, and a mapping system to navigate. ese technologies can be used to determine environments and locations and recognize the suitable routes amid obstacles and signage . AVs are supposed to minimize vehicle accidents, enhance the flow of traffic and movability, reduce the utilization of fuel, be free from driving, and facilitate business operation and transportation . Despite the massive potential advantages, there are many unsolved safety, security, legal and regulatory, social, ethical, and technology issues. In the AV system, it is expected to solve all the problems to avoid failure. In this survey, design, hardware, AI-based, and safety issues and current solutions of autonomous vehicles are discussed. Furthermore, scope of improvement in these solutions is provided as directions for AV research community.

Intelligent software and tools are required for efficient design and development of AVs. ese tools are used during path planning, object detection, perception, act, operational testing, and risk assessment phases. In this survey, comprehensive analysis of tools is provided. Various tools and frameworks such as SysWeaver, SysAnalyzer, AutoSim, Flow, OpenCV, JESS, FuzzyJ, AuRa, and PaddleCV are analyzed based on functionality and applications. e latest releases and versions such as AutoSim 200, OpenCV 4.5.5, and FuzzyJ 1.2.2 are discussed so that researchers can contribute in various open-source tools and frameworks.

Since the middle of the 1980s, several car companies, research institutes, universities, and industries worldwide have studied and developed AV. To promote AV technology, there are well-known competitions. For example, 2007 Urban Challenge and 2005 DARPA Grand Challenge are organized by Defense Advanced Research Projects Agency (DARPA). In the USA, the first competition of DARPA Grand Challenge was organized in which AV was required to navigate 142 miles long desert track within 10 hours.

SCOPE OF THE PROJECT:

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The project focuses on designing an autonomous vehicle using IoT and Embedded C, aiming to develop a functional prototype that can navigate and interact with its environment autonomously. The vehicle will be equipped with various sensors such as ultrasonic, GPS, and cameras to gather real-time data for decision-making. Using Embedded C, the microcontroller will process sensor inputs and control the vehicle's motors and actuators to enable obstacle avoidance, path planning, and basic navigation. IoT technology will be integrated to allow wireless communication between the vehicle and external devices, such as a remote server or mobile application, for real-time monitoring and control. The vehicle will be able to transmit data, including its location and sensor readings, to a cloud platform for analysis and feedback.

The project also involves testing the vehicle in controlled environments to validate its performance, reliability, and real-time responsiveness. The system will be optimized to handle various obstacles, ensuring that the vehicle can adapt to dynamic changes in its environment. While the primary focus is on building a functional autonomous vehicle, the project also explores the challenges of sensor integration, real-time processing, and communication latency, while also considering future enhancements like machine learning for more advanced decision-making. The goal is to create a robust foundation for developing smarter, more efficient autonomous transportation systems.

- **PROPOSED SYSTEM**

Autonomous transportation within gated communities and hotels aims to address key issues found in existing models. While current autonomous buggies and shuttle carts offer convenience, they often face limitations in terms of adaptability and scalability. Many existing systems rely on fixed routes, making them less flexible in accommodating dynamic changes in traffic flow or unexpected events, such as construction or large gatherings. Additionally, the dependence on GPS and basic sensor systems can lead to issues in dense or poorly mapped environments, where accuracy may be compromised, affecting navigation and safety. Our proposed system would leverage advanced real-time mapping, AI-driven decision-making, and dynamic routing capabilities to enhance flexibility and navigation accuracy, ensuring better adaptability to varying conditions and providing a more responsive service to users.

Furthermore, existing systems sometimes face integration challenges with infrastructure, especially when it comes to seamless interactions with gated access points, security systems, or pedestrian traffic. Many autonomous vehicles operate on a limited scale, often requiring human intervention for maintenance or to resolve issues. Offers a more efficient, flexible, and secure transport option within gated communities and hotels.

BLOCKED DIAGRAM:

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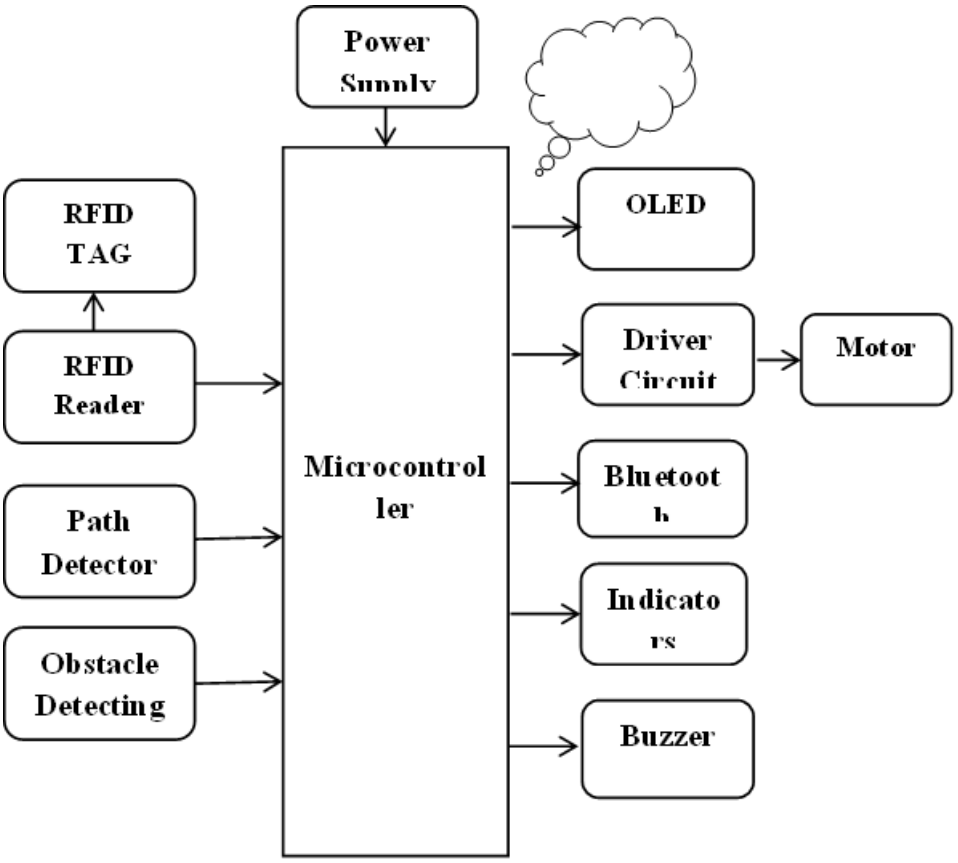

Fig: Rasberry Pi Pico

POWER SUPPLY:

The power supply section is the section which provide +5V for the components to work. IC LM7805 is used for providing a constant power of +5V.

The ac voltage, typically 220V, is connected to a transformer, which steps down that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.

A regulator circuit removes the ripples and also retains the same dc value even if the input dc voltage

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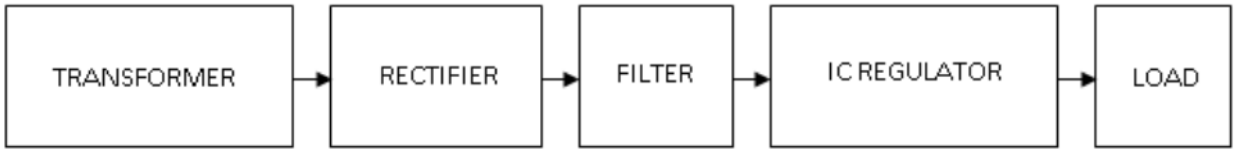
varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.



Block Diagram Of Power Supply

OLED:

OLED (Organic Light Emitting Diodes) is a flat light emitting technology, made by placing a series of organic thin films between two conductors. When electrical current is applied, a bright light is emitted. OLEDs are emissive displays that do not require a backlight and so are thinner and more efficient than LCD displays (which do require a white backlight).

OLED displays are not just thin and efficient - they provide the best image quality ever and they can also be made transparent, flexible, foldable and even rollable and stretchable in the future. OLEDs represent the future of display technology.

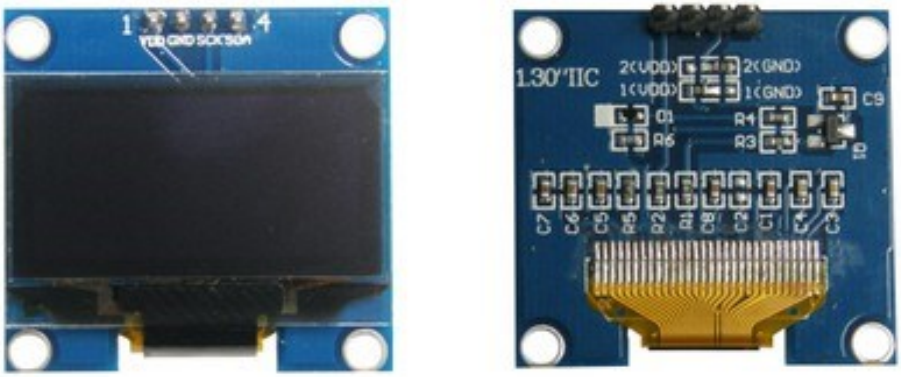


FIG: OLED

RFID:

The reader, or scanner, functions similarly to a barcode scanner; however, while a barcode scanner uses a laser beam to scan the barcode, an RFID scanner uses electromagnetic waves. To transmit these waves, the scanner uses an antenna that transmits a signal, communicating with the tags antenna. The tags antenna receives data from the scanner and transmits its particular chip information to the scanner.

The data on the chip is usually stored in one of two types of memory. The most common is Read-Only Memory (ROM); as its name suggests, read-only memory cannot be altered once programmed onto the chip during the manufacturing process. The second type of memory is Read/Write Memory; though it is also programmed during the manufacturing process, it can later be altered by certain devices.

RFID Tag

RFID tag is a small device which stores and sends data to RFID reader. They are categorized in two types – **active tag and passive tag**. Active tags are those which contain an internal battery and do not require power from the reader. Typically active tags have a longer distance range than passive tags. Passive tags are smaller and lighter in size than the active tags. They do not contain an internal battery and thus depend on RFID reader for operating power and certainly have a low range limited up to few meters.

IR SENSOR

IR sensor is very useful if you are trying to make a obstacle avoider robot or a line follower. In this project we are going to make a simple IR sensor which can detect a object around 6-7 cm. IR sensor is nothing but a diode, which is sensitive for infrared radiation. This infrared transmitter and receiver is called as IR TX-RX pair.

ULTRASONIC SENSOR

Ultrasonic sensors (also known as transceivers when they both send and receive) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.

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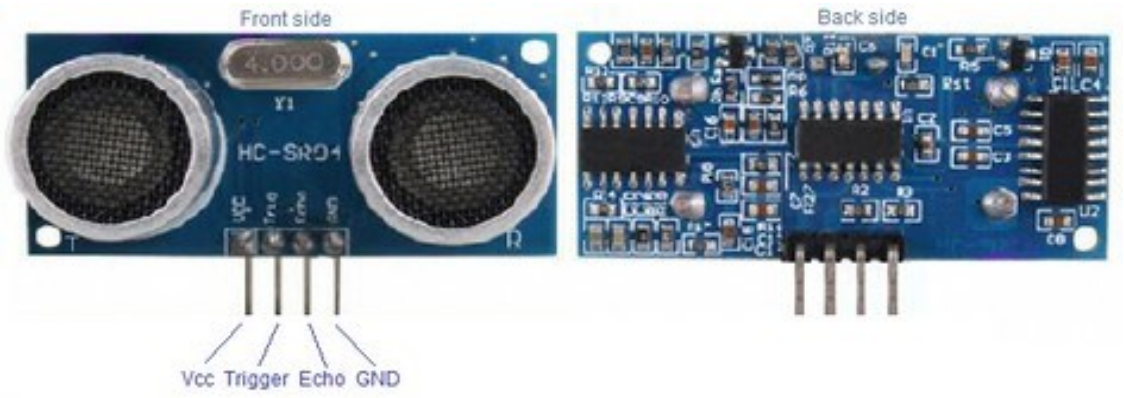
This technology can be used for measuring: wind speed and direction (anemometer), fullness of a tank, and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure the amount of liquid in a tank, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultrasonography, burglar alarms, and non-destructive testing.



CONCLUSION

The scientific community now accepts autonomous vehicles and autonomous driving as feasible solution due to advancement in AI. With artificial intelligence, autonomous vehicles and driving systems may make a choice that propels the industry into a new era of rapid development. Despite this, artificial intelligence has significant limitations, limiting the growth of autonomous driving. is work has conducted a comprehensive survey over artificial intelligence in autonomous vehicles, systems, and driving experiences. In observations, it is found that there is a lack of safety standards for autonomous systems, and AI is an important concept while designing the safety standards for futuristic autonomous systems. Furthermore, a comparative analysis of various studies on autonomous systems shows that integrating two or more advanced technologies (blockchain, IoT, cloud computing, fog computing, edge computing, and artificial intelligence) is required to make autonomous systems a reality.

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