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AI - Enabled Unmanned E- ATV

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ABSTRACT –

The project focuses on the most important aspect of the ATV – All Terrain Vehicle concept with the interfacing with internet. The microcontroller we are using here is AI Thinker NodeMCU-ESP8266. This controller is interfaced with sensors to detect the data and communicated with the server through wireless network protocols based on the IEEE 802.11 family of standards. Further the user can interface with the vehicle through the microcontroller, as its functioning as transceiver of the commands and data respectively.

The device is used to operate in remote areas and with the interfacing of internet, AI can be enabled based on the user requirement. Ultrasonic sensor is fitted in the front and read side of the vehicle for the initial detection of the obstacles. Further Arducam Mega Camera is fitted in the vehicle to take photo and send it to user via the network based protocol.

Once its operational, the vehicle can function without any human assistance by means of solar power, that gets stored in the battery. The vehicle parallelly can be used for detecting, sensing and will share the data back to the user in critical military related environments. Based on real life situations, AI can be programmed to perform the task.

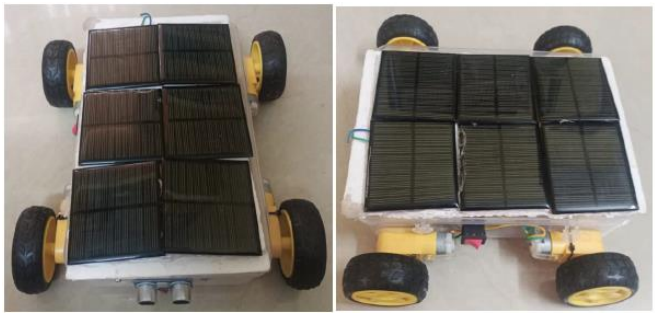
***Keywords*: ATV, MCU, sensor, transceiver, protocol.**

I. INTRODUCTION

The aim of designing, creating the circuit and making a prototype of AI -enabled Unmanned E - ATV is executed successfully. The code for the functioning of the device is successfully compiled and loaded into the AI Thinker NodeMCU-ESP8266 via Arduino IDE software.

The prototype of all-terrain vehicle is powered by solar panel fitted on the top of the vehicle. Solar panels convert the solar energy to chemical energy and gets stored in the Li-ion battery. Thus E- powered AI enabled vehicle, has smart detection and sensing using camera and sensors respectively, transmit and receive data from the user and can be securely operated in remote if required. Further the device is created to give an edge over existing vehicles in terms of technicality and operability in extreme conditions.

The feature of data transmission is done via secure protocol to protect the data and further the device can be upgraded and customized based on the specialized requirement of the user. The vehicle is capable in deployment of explosives in a precisely marked terrain which can be loaded in the program and can be controlled by the user. The rising use if Artificial Intelligence in the automotive domain and military sector, further increases the scope of this project and suitable upgradation can be done.



II. LITERATURE SURVEY

Review and Analysis of Literature on Autonomous Driving - Juan Rosenzweig, Michael Bartl Autonomous Driving has been said to be the next big disruptive innovation in the years to come. Considered as being predominantly technology driven, it is supposed to have massive societal impact in all kinds of fields. In this section a brief overview on the technology and development will prove helpful to understand the need of customer acceptance on the topic that until now has been, as demonstrated.

According to Marlon G. Boarnet (Ross, 2014, p. 90), a specialist in transportation and urban growth at the University of Southern California "Approximately every two generations, we rebuild the transportation infrastructure in our cities in ways that shape the vitality of neighborhoods; the settlement patterns in our cities and countryside; and our economy, society and culture" and as many believe, autonomous driving cars are this new big change everyone is talking about.

Leading not only to high impact environmental benefits such as the improvement of fuel economy (Payre, et al. 2014; Luettel, et al., 2012) , through the optimization of highways (Luettel, et al., 2012; Le Vine, et al., 2015; Payre, et al., 2014;

One of the main concerns for all semi-autonomous features in the literature is that humans are poor monitors of automation (Bainbridge, 1983) meaning that driving performance declines as automation increases, leading to big safety concerns while being "out of the loop" in case of necessary reaction (Hamish Jamson, et al., 2013; Weyer, et al., 2015; Merat, et al., 2012), situation that is imminent until the technology is fully automated.

Moreover, John Leonard (Knight, 2013), a MIT professor, reasons that current technology relies on very accurate prior maps and that keeping maps up to date shouldn´t be underestimated, while his colleague Bryan Reimer, a research scientist in MIT's Age Lab, argues that the most inhibiting factors related to Autonomous driving "will be factors related to the human experience"

A Literature Survey of Unmanned Vehicle Usage for Civil Applications - Mithra Siva Kumar Naga Malleswari TYJ An unmanned system (US) or UV is an electromechanical system that does not have a human operator on board. Unmanned vehicles can be controlled remotely or independently, depending on pre-programmed programs. A UV/US is used in several settings because of advancements in safety. (Zhuo et al. 2017).

Beginning as Google's exploration of self-driving vehicles, Waymo is now its own company creating driverless vehicles that can safely deliver people from points A to B. With over 20 million autonomous miles driven to date, Waymo's 360-degree perception technology detects pedestrians, other vehicles, cyclists, road work and other obstacles from up to 300 yards away.

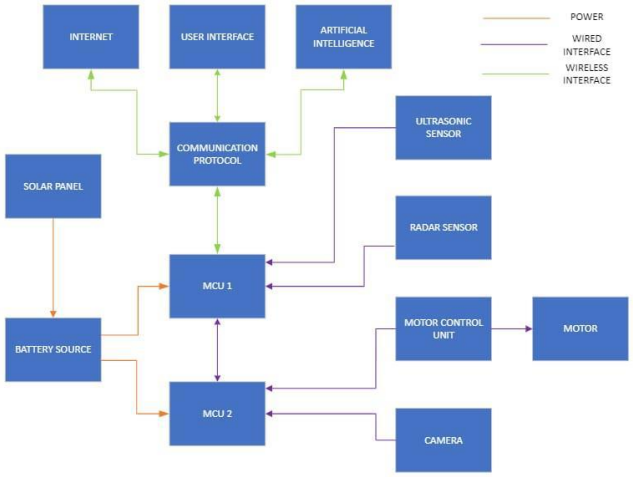
Autonomous cars now use cloud computing and deep learning technology, among other things, to act on traffic data, weather, maps, adjacent cars, and surface conditions. This allows them to better monitor their surroundings and make intelligent choices.

III. PROPOSED METHOD

A novel method is presented in this prototype vehicle to create a functional AI- enabled unmanned electric vehicle. The project utilizes microcontroller based functional aspect and movement control system. The operation of the vehicle, data it transmits and receives is all done through a secure wireless communication protocol. The MCU is coded with embedded C language program to calculate the relevant data through sensors and accessories. These data is collected and shared with the user in real time. User can manually operate the vehicle and also let Artificial Intelligence control the vehicle totally through enabling the option. In possible areas of operation, the batteries can be self - charged through the fitted solar panel on top of the vehicle. The system for AI-enabled unmanned all-terrain vehicles is a complex and rapidly evolving field. By leveraging the latest sensor and camera technologies, communication modules, and machine learning algorithms, UATVs are becoming increasingly sophisticated and capable of navigating through even the most challenging environments. By enabling the vehicle to function in E- powered way under all circumstances is even more challenging task ahead, considering the existing battery technologies. Unmanned electric vehicles are highly energy-efficient, and as renewable energy sources become more prevalent, we can expect to see a shift towards more sustainable transportation solutions. This could have significant environmental benefits and help to reduce our dependence on fossil fuels. However, there are still many challenges that need to be addressed, and further research and development are needed to fully realize the potential of these technologies.

A. Block Diagram

The Figure 1 shows the block diagram of the prototype model of AI enabled unmanned E – ATV. The source of power for the complete vehicle is by Li-ion battery source. Solar panel is used to charge this battery pack and externally also it can be charged based on the requirement. An AI Thinker Node MCU is used as the primary microcontroller board. This controls all of this device's communications with the user and AI through internet. It is attached to an Arduino pro mini board that functions as a secondary controller to interface with motor control unit, camera. The radar sensor and ultrasonic sensor are interfaced with the primary controller.



B. AI Thinker NodeMCU-ESP8266

AI Thinker NodeMCU-ESP8266 is an open-source firmware and development kit that helps you to prototype or build IoT products. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The firmware uses the Lua scripting language. It is based on the eLua project and built on the Espressif Non-OS SDK for ESP8266. The AI Thinker NodeMCU-ESP8266 Development Board is a development board based on the ESP8266 microcontroller. It is designed to make it easier to develop Internet of Things (IoT) applications and projects.

The NodeMCU-ESP8266 development board provides a convenient way to connect the ESP8266 microcontroller to a USB port for programming and power. It also has a number of GPIO pins that can be used for digital input and output, as well as analog input.

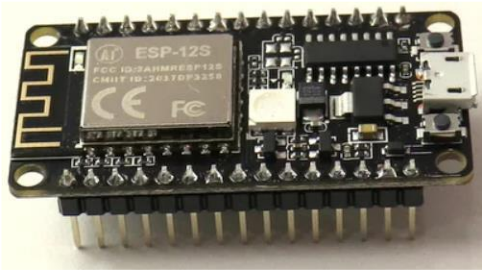


Fig.2 AI Thinker NodeMCU-ESP8266

C. Arduino pro mini

The Arduino Pro Mini is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, an on-board resonator, a reset button, and holes for mounting pin headers. A six pin header can be connected to an FTDI cable or Spark fun breakout board to provide USB power and communication to the board.

The ATmega328P microcontroller is a 8-bit microcontroller with 32KB of flash memory, 2KB of SRAM, and 1KB of EEPROM. It runs at a clock speed of 16MHz and has a wide range of features including analog-to-digital conversion, digital input/output, PWM, interrupts, and serial communication.

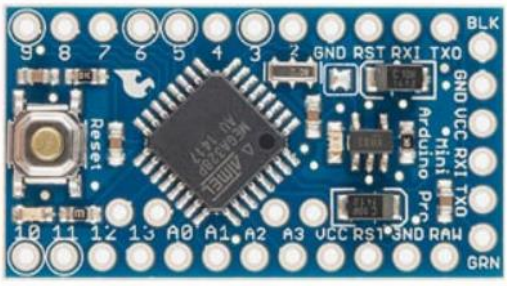


Fig 3. Arduino Pro Mini

D. Sensor and camera

There are totally two different types of sensors (ultrasonic and automotive radar sensor) used in our existing model, and a camera added to capture the image and send it to the user based on the requirement.

An automotive radar sensor is a type of sensor used in vehicles to detect objects and provide information to the vehicle's driver assistance systems.

The sensor emits radio waves or microwaves and then measures the time it takes for the waves to bounce back after hitting an object. By analyzing the time and frequency of the reflected waves, the sensor can determine the distance, speed, and direction of objects in the surrounding environment.

An ultrasonic sensor is a type of sensor that uses sound waves at a frequency above the range of human hearing to detect objects and measure distance. The sensor emits a high-frequency sound wave and then measures the time it takes for the wave to bounce back after hitting an object. By analyzing the time and frequency of the reflected wave, the sensor can determine the distance of the object.

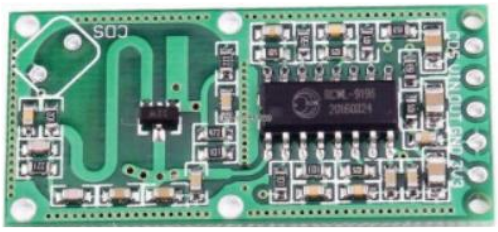


Fig.4 Radar sensor

An ultrasonic sensor is a type of sensor that uses sound waves at a frequency above the range of human hearing to detect objects and measure distance. The sensor emits a high-frequency sound wave and then measures the time it takes for the wave to bounce back after hitting an object. By analyzing the time and frequency of the reflected wave, the sensor can determine the distance of the object.

Ultrasonic sensors typically operate in the range of 20kHz to 200kHz, with a typical range of up to several meters. They are often designed to work in a variety of environmental conditions, including temperature and humidity fluctuations, and can operate in a wide range of lighting conditions.

Fig.4 Ultrasonic sensor

IV.WORKING

At its core, an AI Thinker Node MCU has esp8266 which is an advanced microcontroller board, which is essentially an entire computer on a chip. It has a processing core, memory, and input and output controls all in one chip. The AI Thinker Node MCU development board features a microcontroller unit (MCU), which is based on the ESP8266 system-on-chip (SoC) that integrates a Wi-Fi module and a powerful 32-bit RISC processor. The board also has several onboard peripherals, such as GPIOs, ADCs, PWMs, I2C, SPI, and UART, which can be used to interface with various sensors and devices.

It uses three main things to do its job:

Inputs: Sensors and camera are connected to the controller to give it information. These are called inputs, and they can be nearly anything from on/off signals, variable voltage signals, or communication from another controller. As long as a sensor’s voltage range works with the controller, you can probably use it.

Programming: The board is programmed to take its inputs and make decisions based on the information it receives. The programming can be as simple as turning on a light when a switch turns on or something more complex like sending weather information to a web browser. Programming can be done in the Lua scripting language, which is a programming language that is easy to learn and can be used to build IoT applications Arduino IDE, VS Code, or even Python for some boards.

Outputs: Finally, the output is the signal the controller sends to the communication protocol. As with the input, the output can be an on/off, variable voltage, or communication signal.

The device functions based on the code fed into the controller. The code is written exclusively for the functions of movement of the vehicle through user control, AI enabled, sensor data based movement. Since the vehicle is electrically powered, it can operate in any environment and climatic conditions.

User can operate the vehicle based on the requirement and this will be utilized to detect the sensory data, analyze it and operate the vehicle based on the instructions. The device is operated with the battery power. Li-ion battery cells are used as battery pack. Solar panel is used to charge the batteries in suitable conditions. An AI-enabled unmanned electric all-terrain vehicle (E-ATV) is a vehicle that can operate autonomously without human intervention.

It is equipped with advanced sensors, cameras, and artificial intelligence algorithms that enable it to detect and avoid obstacles, navigate through different terrains, and perform various tasks. The AI algorithms that control the E-ATV are designed to analyze sensor data in real-time and make decisions based on the information received.

For example, if the vehicle detects an obstacle in its path, it can automatically adjust its speed or change its direction to avoid a collision.

Additionally, the E-ATV can be programmed to perform specific tasks, such as mapping an area, collecting data, or delivering goods. This makes it useful for a wide range of applications, from agriculture and mining to military and emergency response.

Overall, an AI-enabled unmanned E-ATV is a powerful and versatile tool that can help automate various tasks and improve efficiency in a wide range of industries.

V. RESULTS AND DISCUSSION

Thus, the aim of designing and creating a prototype circuit for unmanned electrical vehicle is created and executed successfully

 The code for the functioning of the device is successfully compiled and loaded into the AI Thinker Node MCU via Arduino IDE software.

 AI enabled unmanned operation, user controlled movement and operation, observing and transmitting suitable user required data by suitable interfacing is done and executed successfully.

 Thus the designing of an innovative circuit that enables the user to control the vehicle through very secure mode of communication was completed successfully.

ADVANTAGES:

The prototype E - vehicle is innovative and completely working as per user requirement.

The user can customize the vehicle as per his requirement in different operational modes.

Additional sensors could be interfaced to improve the AI functionality.

CONCLUSION

Thus the design and prototype creation of the AI-enabled, Unmanned E-ATV is done successfully by an innovative approach. By using suitable sensors, microcontroller, the user required data can be observed and sent via communication protocol. It’s possible to create and execute such a complicated device, by means of programming and proper interfacing of the e-components.

Further the vehicle can be modified to GSM and GPS module to include SIM access, location based data and other advanced feature. Once implemented in real time application, this would be a potential game changer in defence related manufacturing industry and other automobile industries. ulcers are largely preventable in nature, and their management depends on their severity. The available literature about severity of pressure ulcers, their classification and medical care protocols have been described in this paper. Nutrition plays a very important role in any wound healing process so in pressure ulcers, compounding the effect of older age, diabetes and many other medical conditions hampering adequate intake of nutrition. Protein energy malnutrition is directly related to the occurrence as well as healing of the pressure ulcer. Apart from biochemical data nutritional assessment should be done by other changes, such as weight changes, fluid intake, wound healing or progression. Pressure ulcer prevention and treatment guidelines should include guidelines that have nutritional recommendation too like National Pressure Ulcer Advisory Panel/EPUAP guidelines. Pressure ulcers are often, but not always, preventable. The occurrence of such an ulcer signals the possible presence of chronic comorbid disease and should prompt a search for underlying risk factors in patients for whom ulcer treatment is considered appropriate.

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