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MULTI-PURPOSE ROVER USING INTERNET OF THINGS AND ARTIFICAL INTELLIGENCE IN WIRELESS COMMUNICATION SYSTEM

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Abstract - In the era of science and technology where everything is at pace i.e., the communication is done at high-speed transfer of information. The communication done at high speed requires precision and accuracy. This paper is based on multipurpose rover using voice controlled and artificial intelligence. Generally, a rover part in divided in three different layers: Perception layer, Network layer, and Application layer. Perception layer consist of main controller part. Network layer consist of router which connects perception layer and application layer using internet. In the application layer, the value of each reading will be stored in database which is created using SQL language. Once value stored in database, we can retrieve the value whenever we want and display it on webpage.

Key Words: Artificial Intelligence, Esp32, IR sensor, ArduinoIDE, Camera, Image Processing.

1. INTRODUCTION

In any case of disaster, the current technologies involve lot of human effort and error. In military, there are many situations which would be made less risky if an unmanned object is first sent for scouting before the troops are sent. These are some of the situations in real-life that have motivated us to create a Multipurpose Unmanned Rover.

After doing literature survey, the issues discussed in the references were regarding wired medium, night vision, storage, data transmission speed, range limitation and external controller. The outcomes were establishing Wi-Fi interface , night vision was the improvement made. Processor was used efficiently as it was low end processor with high end application. Accuracy was increased to 1km ,delay in sending sensed data was observed. Six wheeled driving system was used in order to adapt to any terrain.

Methodologies were wireless communication for communication system, android application and website for data visualization and building maps using sonar sensor, gyroscope, compass signaling, encoder. Future scope for the same were stated as data transmission delay can be eliminated. Sensor readings can be stored in cloud directly over internet. Rover can be used for multi-functions. Implementation of IoT and AI can also be used to automate the process.

2. FLOW DIAGRAM

The proposed flow diagram is given

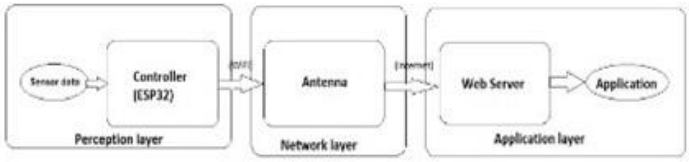

Fig-1: Flow Diagram

In Fig-1, the flow of process is explained as follows:

1. System is started when we give power supply.
2. The sensor active at that time. Sensor senses the surrounding environment and send the data to controller.
3. The reading from the sensor controller captures it and sendto into database.
4. The camera inserted on controller start live streaming. Itcaptures images and videos.
5. Captured data send to the database using controller.
6. The server sends the data to user whenever user want.

3. HARDWARE AND SOFTWARE REQUIRMENTS

3.1 Hardware

- ESP32
- IR Sensor
- DHT11 Sensor
- Camera
- Ultrasonic Sensor

A. ESP32:

Features:

- Low-cost
- Low power system on a chip microcontroller
- Integrated Wi-Fi
- Dual-mode Bluetooth.

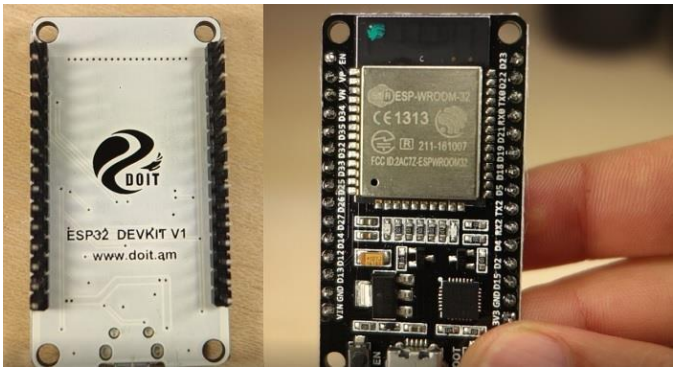

Fig-2: ESP32

• The clock frequency -up to 240MHz and its RAM is 512 kB, 30 or 36 pins, 15 in each row.
• It has built-in hall effect sensor and built-in temperature sensor.

B. IR SENSOR

IR sensors are tuned to listen to infrared light. Remote control detection is its use.

Fig-3: IR Sensor

Specifications: -

• 5VDC Operating voltage
• I/O pins are 5V and 3.3V compliant
• Range: Up to 20cm. Built-in Ambient Light Sensor
• 20mA supply current

C. ULTRASONIC SENSOR

An ultrasonic sensor is device that measures the distance of a target by ultrasonic sound waves. It converts the reflected sound into an electrical signal

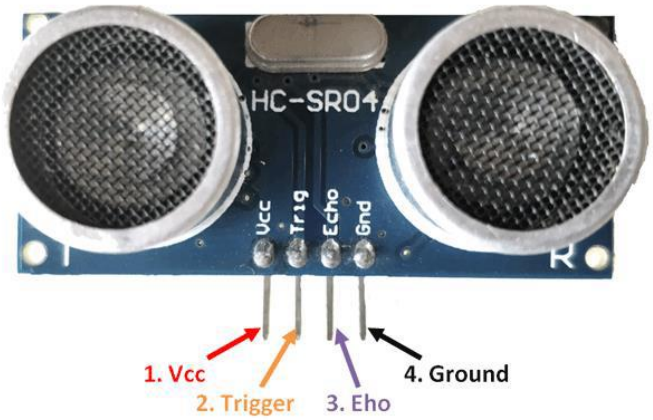

Fig-4: Ultrasonic Sensor

Specification: -
• Operating voltage: +5V
• Theoretical Measuring Distance: 2cm to 450cm
• Practical Measuring Distance: 2cm to 80cm
• Accuracy: 3mm
• Measuring angle covered: <15°
• Operating Current: <15mA
• Operating Frequency: 40Hz

D. CAMERA MODULE

The ESP32CAM is a tiny module. Programming the ESP32CAM through the ESP-IDF by installing the ESP32 Core is possible. The ESP32 with everything necessary to program, run and develop on the wonder chip is equipped by ESP32CAM.

• Built-in Flash: 32Mbit
• RAM: Internal 512KB + External 4M PSRAM
• Antenna: Onboard PCB antenna
• Wi-Fi protocol: IEEE 802.11 b/g/n/e/i
• Bluetooth: Bluetooth 4.2 BR/EDR and BLE
• WIFI mode: Station / SoftAP/SoftAP+Station

Fig-5: Camera Module

Output image format: JPEG (OV2640 support only)
• Supported TF card: up to 4G
• Peripheral interface: UART/SPI/I2C/PWM
• IO port: 9
• UART baud rate: default 115200bps
• Power supply: 5V

E. DHT11

The basic, ultra-low-cost digital temperature and humidity sensor is DHT11. It is a capacitive humidity sensor. Simple to use and requires timing to grab data.

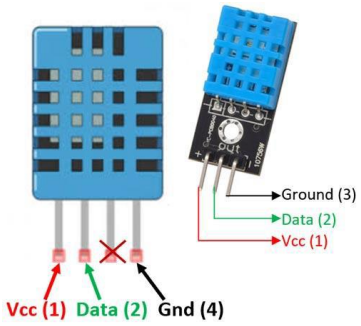

Fig-6: DHT11

Specification:
• Operating Voltage: 3.5V to 5.5V
• Operating current: 0.3mA (measuring) 60uA (standby)
∴ Resolution: Temperature and Humidity both are 16-bit
• Accuracy: ±1°C and ±1%

3.2 Software

A. Arduino IDE

The Arduino Integrated Development Environment -or Arduino Software (IDE) is used to program the board by writing code in text editor and connecting board to USB to upload code. We can observe the working in serial monitor.

B. Eagle

It is used for PCB designing. We can design the boards according to our needs. It helps us to understand and learn designing process. Autodesk developed it.

C. XAMPP

Apache Friends developed XAMPP is an open-source cross-platform web server solution stack package. It helps us to demonstrate and use web server. Also stores the data in MySQL database.

4. RESULTS AND DISCUSSIONS

The multipurpose rover system is created which can perform the work of three to five people, depending on the task It gives us various information about surrounding in real time and gives us proper output. We demonstrate our website which shows us output like images, sensor data and live streaming. The image processing database and final output are successfully demonstrated.

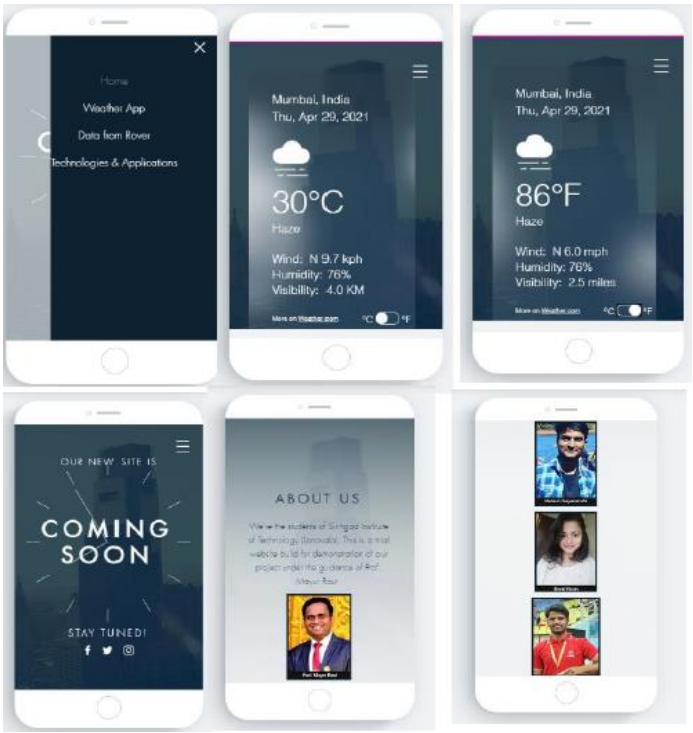

Fig-7: Website for data visualization of sensed data

The Fig-7 demonstrates the website created for presenting sensed data to the user

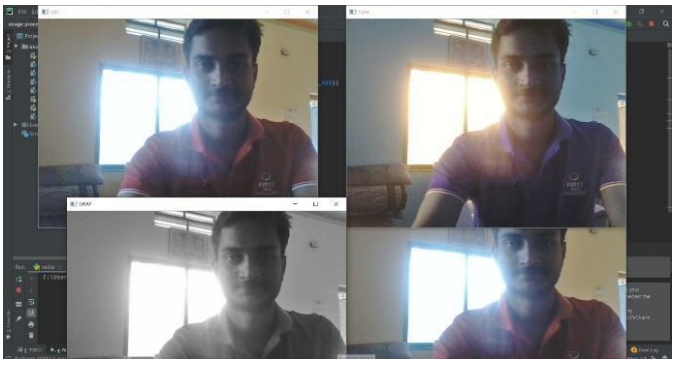

Fig-8: Image Processing Implementation

Fig-8 shows the implementation of image processing on video live stream from camera of rover. The stream is converted in various image types like grayscale, RGBA, etc. and displayed in different frames.

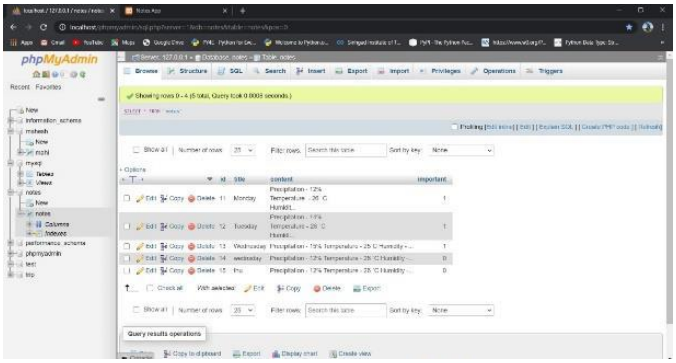

Fig-9: Xampp Database Demonstration

In Fig-9, Xampp Database is displayed which is used to store sensed data and display on Notes App in Fig-10.

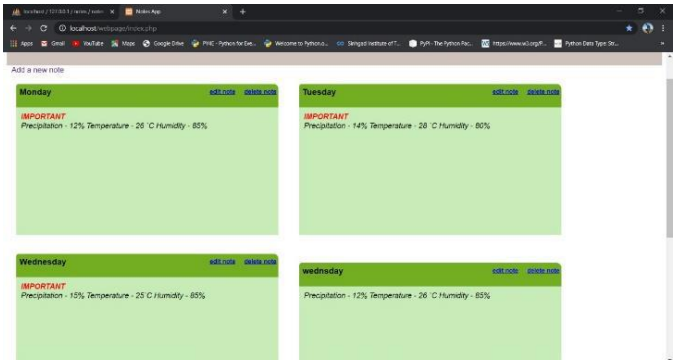

Fig-10: Notes App

Fig-10 displays Notes App that presents humidity and temperature stored in database.

5. CONCLUSIONS

The movement of the proposed robot can be controlled wirelessly either from the control unit within its transmitter's range or from any distance.
For civil use, surveillance of mall, parking lot, office, industry, bank, museums, helping rescue operation during natural disaster. For military for surveillance purpose.

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