Second International Conference on Smart Computing and Communication for Sustainable Convergence (ISCCSC 2025)

CONSOLE LESS HAND GESTURE CONTROL DRONE

Amrutha R[1], Darshan Gadi[2], Gangadhar S J[3], Prajwal B[4] and Roshan Shetty[5]

Department of Electronics and Communication Engineering, Alvas Institute of Engineering & Technology, Moodbidri, Mangalore, Karnataka, India
Emails: : amrutharamesh029@gmail.com[1], darshangadi07@gmail.com[2], gangadharjo19@gmail.com[3], prajwalbilagi244@gmail.com[4], roshans@aiet.org.in[5]

Abstract.

Gesture-controlled drones employ glove sensors that use accelerometers and gyroscopes to record motion in place of traditional controllers. This kinetic data is sent to the drone, allowing it to react to the user's movements naturally. In order to prevent collisions, the drone's obstacle sensors continuously detect nearby objects and automatically alter or stop its movement Second, the gesture information is transmitted to the microcontroller of the drone, which processes and acts upon the command. E., off, lift, turn. Lighting variability further limits visual control efficiency, favoring sensor-based options. Wireless with drone wire with sensor quick and easy. And thats a big plus because if you dont want to leave your house of work you can just use the drones and see what your doing or you can send it out to rescue someone or you can used it to walk through a dangerous place this project is a new interaction paradigm where users can operate flying drones with a wearable sensor, providing an innovative and engaging experience.

Keywords: Security Monitoring, Rescue Operations, Industrial Inspection, Scientific Research, Media and Entertainment, Healthcare, Agriculture, Autonomous Vehicles, Streaming Media, Drone Management.

1. INTRODUCTION

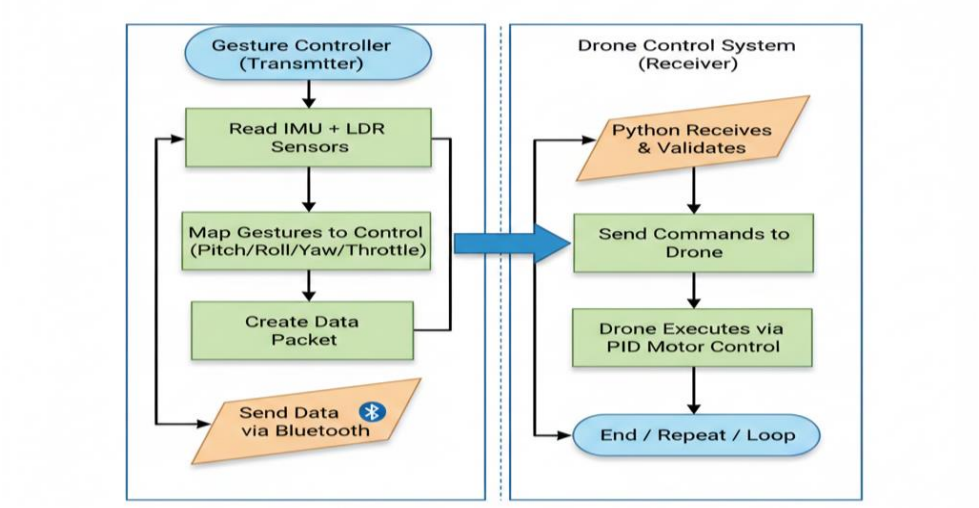
Uavs or drones can do alot of comanys like farming disater delivery saftey and alot more becaysethey can do it by themselfsthey are super easy to use and they realy cheep that why more and more pepel are trying to use uavs and drones to develope a new form of human digital interation hdi witch some have spetulated will eventualy replace the more userfriendly physcal remoute

Gesture input device is a type of input device that can detect hand or body movement made by the user and transform those gestures into commands for the computer for example through visual recognition by a camera or through sensors embedded in gloves for example by deep learning models such as convolutional neural network CNN or residual neural network RNN architectures which have achieved accuracy rates exceeding

90 in simulated environments demonstrating promising potential for future use outside of laboratory environmentsThese systems could be used for tracking moving objects, avoiding obstacles on uneven surfaces, or performing other tasksGesturebased input systems are designed to be userfriendly and intuitive, offering an alternative control method for users unfamiliar with the technology and replacing physical contact with objects or surfaces.

Furthermore, ROS integrated with Raspberry Pi and NodeMCU offers a decentralized and simplified robotic architecture.but this does not mean that they have to make some new friends, hang out and have some fun or play shoot on the game and i just want to say that i could put vr in my project and i will go on to describe below what i have done, what i am doing and what i going to put in my project.

2. METHODOLOGY OF WORK FLOW



Gesture are detected by the system for uav control and input data are processed through the imu and optical sensor in order to track the hand movement it then generates control data including pitch , roll , yaw and throttle and wirelessly transmits this information to the drone the pi d control algorithm keep the motor in a stable condition, it is also very easy to use , it enables the uavs to control in a simple way and it does not require the user to have ever flown a drone before.

The proposed system consists of two major modules:
(1) The Gesture Controller (Transmitter). and
(2) The Drone Control System (Receiver).

A. Gesture Controller (Transmitter Side)

1. **Sensor Data Acquisition (IMU + LDR Sensors) :** The gesture controller continuously collects motion and orientation data using an Inertial Measurement Unit (IMU), which provides accelerometer and gyroscope readings. Light dependent resistors are used to detect changes in hand position and movement

during different gestures. These sensors serve as the main input source for recognizing and interpreting human hand gestures.

2. **Gesture Processing and Mapping :** The sensor data is first cleaned to ensure consistent readings and remove unwanted noise. Then, different hand positions and motions are linked to drone controls like pitch, roll, yaw, and throttle.This process helps translate natural human gestures into measurable, intelligible commands for the drone.
3. **Data Packet Formation :** The gesture values are packed into a small data frame to guarantee that the information is sent quickly. This packet includes gesture details, basic error-checking bits, and identification information.These improvements help guarantee that the drone gets reliable and consistent data.
4. **Wireless Data Transmission via Bluetooth :** The transmitter transmits the data packet to the drone via a Bluetooth connection.Bluetooth was chosen due to its low power consumption and consistent communication range. It is also suitable for remote drone control since it enables dependable data transfer.

B. Drone Control System (Receiver Side)

5. **Data Reception and Validation Using Python :** The receiver module is powered by a Python-based interface that continuously searches Bluetooth for information.Each received packet is checked for correctness, signal quality, and format before being accepted.This ensures that the drone only gets valid commands, preventing errors or dangerous motions.
6. **Forwarding Commands to the Drone Controller :** Once the data has been verified, the control values are transmitted to the drone's flight controller.The interface then converts these gesture-based values into motor commands that the drone can understand. This makes it possible for the drone to respond accurately and fluidly to the user's hand movements.
7. **Execution Through PID-Based Motor Control :** The drone uses a Proportional–Integral–Derivative (PID) algorithm to interpret the commands and adjust motor speeds accordingly.
8. **Continuous Real-Time Control Loop :** Data is continuously transmitted, verified, and processed by the system as a whole.The drone and the user can communicate in a responsive and seamless manner thanks to this real-time flow.The drone can thus follow hand gestures with ease and naturalness**.**

The proposed gesture-controlled drone system records hand movements and translates them into flight commands using IMU and LDR sensors. These motions are used to calculate pitch, roll, yaw, and throttle values. The system encapsulates this information into data packets, which are then wirelessly transmitted to the drone via Bluetooth. The flight controller receives valid commands from a Python-based receiver after the data has been verified. The controller uses PID control to ensure responsive and smooth drone movement.

3. REFERENCES

[1] R. A. Suarez Fernández et al., "Natural user interfaces for human-drone multimodal interaction," Proc. 2016 Int. Conf. Unmanned Aircraft Systems (ICUAS), Arlington, VA, USA, 2016, pp. 1013–1022. doi: 10.1109/ICUAS.2016.7502665

[2] Y. Yu, X. Wang, Z. Zhong, and Y. Zhang, "ROS-based UAV control using hand gesture recognition," Proc. 2017 29th Chinese Control and Decision Conference (CCDC), Chongqing, China, 2017, pp. 6795–6799. doi: 10.1109/CCDC.2017.7978402

[3] K. Haratiannejadi, N. E. Fard, and R. R. Selmic, "Smart Glove and Hand Gesture-Based Control Interface for Multi-rotor Aerial Vehicles," 2019 IEEE Int. Conf. Systems, Man and Cybernetics (SMC), Bari, Italy, 2019, pp. 1956–1962. doi: 10.1109/SMC.2019.8914464

[4] S.-Y. Shin, Y.-W. Kang, and Y.-G. Kim, "Hand gesture-based wearable human-drone interface for intuitive movement control," 2019 IEEE Int. Conf. Consumer Electronics (ICCE), Las Vegas, NV, USA, 2019, pp. 1–6. doi: 10.1109/ICCE.2019.8662106

[5] T. Begum, I. Haque, and V. Keselj, "Deep Learning Models for Gesture-Controlled Drone Operation," 2020 16th Int. Conf. Network and Service Management (CNSM), Izmir, Turkey, 2020, pp. 1–7. doi: 10.23919/CNSM50824.2020.9269056

[6] R. Wang and C. Sun, "A Gesture Recognition and Drone Control System Based on Residual Neural Network," 2023 IEEE Int. Conf. Mechatronics and Automation (ICMA), Harbin, China, 2023, pp. 25–30. doi: 10.1109/ICMA57826.2023.10215930

Biographies

Name : Amrutha R
USN : 4AL22EC004
Email : amrutharamesh029@gmail.com
Mobile : 8073244559

Areas of Interest: She is currently pursuing a Bachelor's degree in Artificial Intelligence and Machine Learning at Alva's Institute of Engineering and Technology (AIET), affiliated with Visvesvaraya Technological University (VTU) in Karnataka. Her academic journey reflects a strong interest in core and emerging electronics domains such as Embedded Systems, VLSI Design, Digital Signal Processing (DSP), Microcontrollers , Wireless Communication and Semiconductor Devices.

Name : Darshan Gadi
USN : 4AL23EC400
Email : darshangadi07@gmail.com
Mobile : 9028247949
Areas of Interest: He is currently pursuing a bachelor's degree in Electronics and Communication Engineering at Alva's Institute of Engineering and Technology (AIET), which is affiliated with Visvesvaraya Technological University (VTU) in Karnataka. Microcontrollers, semiconductor devices, PCB design, VLSI design, and digital signal processing are just a few of the traditional and cutting-edge electronics fields in which his academic background indicates a strong interest.

Name : Gangadhar S J
USN : 4AL23EC401
Email : gangadharjo19@gmail.com
Mobile : 8660341587
Areas of Interest: He is currently pursuing a bachelor's degree in Electronics and Communication Engineering at Alva's Institute of Engineering and Technology (AIET), affiliated with Visvesvaraya Technological University (VTU) in Karnataka. Microcontrollers, semiconductor devices, PCB design, embedded systems, are just a few of the traditional and cutting-edge electronics fields that his academic background indicates a strong interest in.

Name : Prajwal B
USN : 4AL23EC404
Email : prajwalbilagi244@gmail.com
Mobile : 8618266034
Areas of Interest: He is currently pursuing a bachelor's degree in Electronics and Communication Engineering at Alva's Institute of Engineering and Technology (AIET), affiliated with Visvesvaraya Technological University (VTU) in Karnataka. Microcontrollers, embedded systems, VLSI design, and digital signal processing are just a few of the traditional and cutting-edge electronics fields that his academic background indicates a strong interest in.

Name : Roshan Shetty
Designation : Associate Professor (Project Guide)
Email ID : roshans@aiet.org.in
Mobile Number : 9538176004
Areas of Interest : As an associate professor at Alva's Institute of Engineering and Technology (AIET), which is connected to Visvesvaraya Technological University (VTU) in Karnataka, in the Department of Electronics and Communication Engineering.