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Intelligent Traffic Management using Drones

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ABSTRACT

The field of robotics is improvising day by day to uplift the modern technology. One such factor is our Hydrolated Espial Drone. The drone is developed in such a way that it can travel in aero space with the help of quad-copter functionality. The system engages with the elements of functional derivates and mathematical control theory to connect nature of Physics and algorithm. The system is deployed with various algorithms like Follow up, Boomerang for live video streaming, aerial photography and for stabilization purposes. The system can be used in various applications for exploring the unexplored area and for providing immediate solutions. In today's road transportation scenario, almost all the major roads especially in cities are bound with frequent traffic problems. This system works in the following ways: finds the road traffic problem location, determines the prone area for road traffic and informs the status to the administrator. The traffic administrator in can turn takes necessary action for an intelligent traffic management.

Keywords - Robotics, Drone, Quad-copter, Streaming

I. INTRODUCTION

Robotics is the branch of science that includes mechanical engineering, electrical engineering, computer science and others. Robotics deals with construction, operation and use of robots, as well as computer systems for their control, sensory feedback and information processing. These technologies are used to develop machines that can substitute for humans. Robots can be used in any situation and for any purpose, but today many are used in dangerous environments (including bomb detection and de-activation), manufacturing processes, or where humans cannot survive. Robots can take on any form but some are made to resemble humans in appearance. This is said to help in the acceptance of a robot in certain replicative behaviors usually performed by people. Such robots attempt to replicate walking, lifting, speech, cognition, and basically anything a human can do. Many of today's robots are inspired by nature, contributing to the field of bio-inspired robotics. The concept of creating machines that can operate autonomously dates back to classical times, but research into the functionality and potential uses of did not grow robots substantially until the 20th century. Throughout history, it has been frequently assumed that robots will one day be able to mimic human behavior and manage tasks in a human-like fashion. Today, robotics is a rapidly growing field, as technological advances continue; researching, designing, and building new robots serve various practical purposes, whether domestically, commercially, or militarily. Many robots are built to do jobs that are hazardous to people such as defusing bombs, finding survivors in unstable ruins, and exploring mines and shipwrecks. Robotics is also used in STEM (Science, Technology, Engineering, and Mathematics) as a teaching aid.

In the initiative of Smart City Management, the major work to be concentrated is on the management of road traffic. Due to the profusion of huge number of vehicles, the road traffic especially in cities are bound to a remarkable hurdle in the overall management of the resources. The current transportation management

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infrastructure and the vehicle parking system have to certainly improve so as to cope with the traffic explosion.

There are more technologies that work on Traffic Management. However, very few technologies are existing for the processing of traffic information in the real time for the immediate actions and decisions for successful traffic control. There is a need to leverage systems that deal with the collection and processing of enormous amount of traffic data and create a smooth traffic environment.

II. EXISTING SYSTEM

In various existing systems, there are drone systems available which are used for various purposes but the signals are transmitted using the inbuilt values. And there is no system with various algorithms incorporated in it. To the knowledge of most of the people involved in Traffic Control and Management, there are no systems that engage with the capacity of drones in it for better implementation. The traditional systems have to equip more converging technologies for effective utilization and for providing better solutions instantly.

Fig. 1 Existing Quadcopters

III. PROPOSED SYSTEM

The proposed system is structured in a way to navigate in space with the quadcopter functionality. The system is mainly used for immediate access situations. For example if traffic is needed to controlled in one particular location of the road, an emergency alert can be sent by the drone systems to the traffic administrators for immediate actions. New Artificial Intelligence algorithms will be implemented like 3D HED, Boomerang, and Follow up algorithm. The system is incorporated with the arducopter which has inbuilt sensors like 3-axis gyroscope, barometer, 3-axis accelerometer, magnetometers. The Boomerang algorithm is employed by using a quadcopter and sensors where the drone reaches to the destined place and returns to the same location. This is done by using sensors like magnetometers and gyroscope using which the distance is calculated. The Follow up algorithm is used to trace the path and the direction of the drone. The system is implemented with the PID (Proportional Integral Derivative) algorithm for the stabilization of the system.

The proposed system methodology is represented in Figure 2. The system involves in understanding the nature of the experiment for the robot to be built, based on various derivatives from the experiments, a model is built and the algorithms proposed are implemented and the system is deployed in the working environment.

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Abundant advantages prevail in using quad-copters with various applications in versatile test platforms. The quad-copters are relatively cheap, they can be developed in a variety of sizes and their simple mechanical design helps the developers to deploy it in various applications. The visual data collected from the device can be used to predict the location where the traffic will move next and in turn it can direct the quad-copter to the next corresponding traffic point.

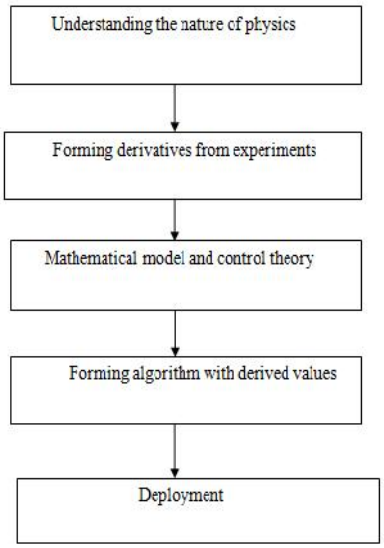

Fig. 2 Proposed System Methodology

The system architecture for hardware explains about the weight of the frame. Based on the frame weight the hardware design is made in + shape. A single battery is connected to four ESC and the Electronic Speed controllers are connected to motors.

SYSTEM ARCHITECTURE-h/w

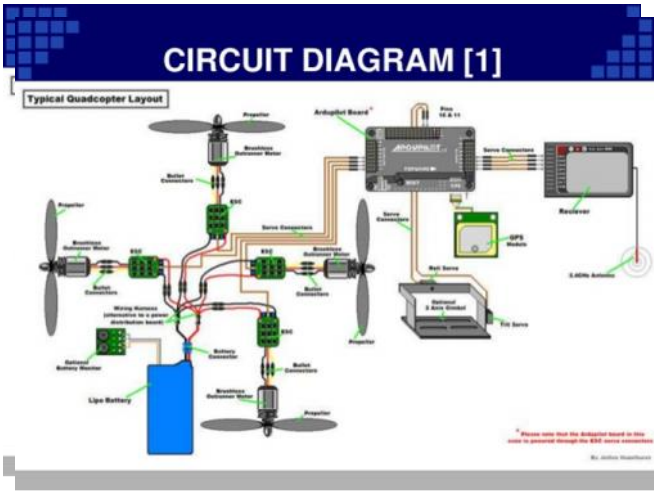

Fig. 3 System Architecture-Hardware

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The system architecture for the software explains all the integrated modules. The interrupts are generated so that the code in the preferred channels of the transmitter and receiver gets executed. The interrupt service routine produces the frequency to the ESC through the micros () function where the started frequency and the current frequency are subtracted to produce the resultant frequency. This resultant frequency helps in lifting up the motors. If any deflection is produced the gyroscope MPU-6050 can be used to sense it and the value at which the deflection is caused is given to the PID algorithm to stabilize it. The stabilized value is given to the motors.

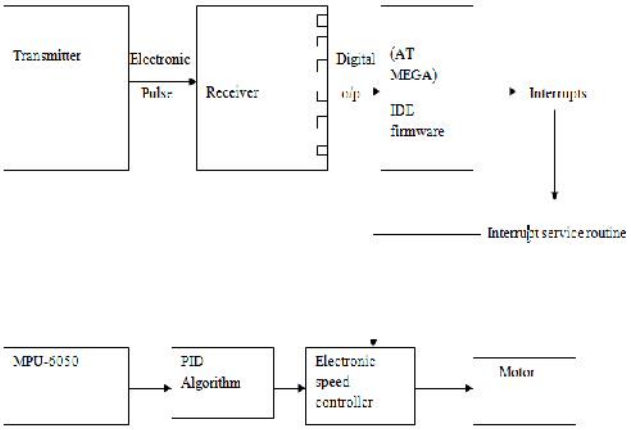

Fig. 4 System Architecture-Software

A.TRANSMITTER-RECEIVER CONNECTIVITY

This module helps in the movement of the device in the upward, downward directions and towards the left and right. In the existing system the transmitting and receiving pulse is set up using the hard-core connectivity i.e.in the form of inbuilt values with the help of the interrupts service routine. Once the signal from the channel of the transmitter is sent it is received in the other end of the receiver channel with the help of the digital pins in the form of the interrupts.

Fig. 5 Transmitter and Receiver Connection

B. GYRO CONNECTIVITY

A gyroscope is a device which consists of a wheel or a disc mounted so that it can spin rapidly about an axis which is itself free to alter in direction. The orientation of the axis is not affected by tilting of the mounting, so gyroscopes can be used to provide stability or maintain reference directions in navigation systems, automatic pilots and stabilizers.

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This module helps in generating the values which are then used for the stabilization purposes. The output of this sensor is taken and used in the PID algorithm. This helps in the stabilization of the system in such a way that the drone goes in the wrong path. The MPU-6050 gyro is used for this purpose.

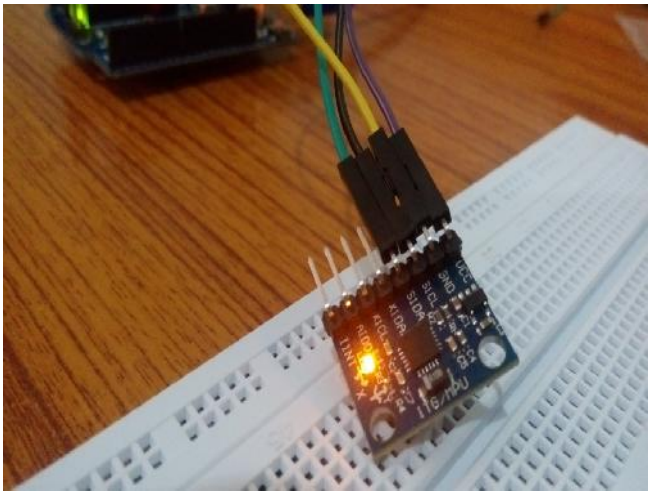

Fig. 6 Gyroscope Connection

C. ESC AND BATTERY

ECS's are often used on motors essentially providing an electronically generator three-phase electric power low voltage source of energy for the motor. Thus the ESC's are meant to manage the robotics brushless motors. The output from the PID algorithm is taken and it is used for the ESC (Electronic Speed Controller) and it is sent to the motor and the value is also used to maintain the voltage of the battery. The ESC determines the amount of current and voltage to be sent for the motors to get lifted.

D. STABILIZATION ALGORITHM

PID (Proportional Integral Derivative) algorithm is used for the stabilization purpose. The PID error is calculated by using this formula as Error=P correction +I correction +D correction. The P correction is calculated as p value * error. The I correction is calculated as I value * error. The D correction is calculated as slope * d-value. The standard maximum and minimum values are determined and the PID algorithm values are taken accordingly. The values of P, I and D are calculated using the below formula

$$u(t) = K_p e(t) + K_i \int_0^t e(\tau)\,d\tau + K_d \frac{de(t)}{dt}$$

E. INTEGRATION OF THE MODULES

All the above mentioned modules are integrated and the different values are given as the input to test the overall system and the output is verified by the motion of the system. The deflection values produced by the gyroscope are corrected and the functionality of the system is made to be worked properly.

IV. CONCLUSION

The proposed work concentrates on the construction of the "Hydrolated Espial Drone" and the usage of the same in the effective control of the traffic in the major roads of the cities. It can also be used for various applications in case of immediate access situations and for the cases where instant solution is necessary. This system eliminates the drawbacks of the existing system and provides immediate better solution for the traffic congestion. This system is also cost effective and does not spoil the environment situation in any way.

V. FUTURE ASPECTS

The future enhancements can be made in such that the system can be able to travel for long distances for even more data collection and processing. Further other new artificial intelligence algorithms can be implemented so that the system can be used for surveillance and detection purposes. Furthermore, designing of a better system for providing a promising smooth traffic flow for ambulances and emergency vehicles can also be done. In future, a system can be developed that collects information variables such as, people violating traffic rules, number of accidents occurring for making better decisions in the analysis and prediction of accidents.

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