CRASH AVOIDANCE SYSTEM FOR DRONES

Project Reference No.: *45S_BE_0039*

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Keywords:

UAV, Robotics, Pixhawk

Introduction:

In a technological sense, a drone is an unmanned aircraft. Unmanned aerial vehicles (UAVs) or unmanned aircraft systems are other terms for drones. A drone is essentially a flying robot. The aircraft may be remotely commanded or fly autonomously thanks to embedded systems that use software-driven flight plans in conjunction with onboard sensors and GPS.

Several factors must be considered to ensure a safe flight while a drone is in the air, there are times when the drone's motor does not respond or fails completely. In this instance, the drone loses its stability and crashes into the ground at a high rate, potentially harming both the drone and its surroundings. Unless an emergency control technique is implemented, the drone will crash.

Drones are high-priced pieces of equipment used in a variety of sectors for a variety of purposes, and losing drones on a frequent basis can be costly. As a result, as a group, we're seeking to fix this problem by focusing on both software and hardware components, as opposed to the present strategy, which is entirely software-focused. We're trying to make a tri- copter out of a quadcopter with four motors (3 motors). This ensures that the drone does not injure itself or the environment.

Objectives:

1. One of the main sources of danger is from propellers. Because propellers have sharp edges, cutting should not be taken lightly and can result in serious injuries. Cuts and lacerations are common when the model is moving. Even little propellers have the potential to cause significant harm. Larger propellers (8" and larger), especially those made of carbon fiber, can readily sever skin, tendons, ligaments, and blood vessels, causing serious wounds. Everyone should be aware that propellers produce deep wounds that bleed profusely and leave scars.
2. The rechargeable batteries are another source of danger. The energy content of modern Lithium polymer batteries is very high. There is an instant danger of fire in

the event of a crash in which the battery is either damaged or a short circuit occurs due to damaged electronics.

Methodology:

When the drone's motor fails, the operator will flip a switch to transform the drone to a tricopter.

The signal for altering the configuration is first sent through the specialised switch on the transmitter. The receiver then sends the signal to the pixhawk.

When the pixhawk receives this signal, it sets its flag to 1 in the code, the ROS modifies the settings, and the circuit is turned on to complete the procedure.

At this time, the drone is in a tricopter configuration, which means it will only examine three motor inputs.

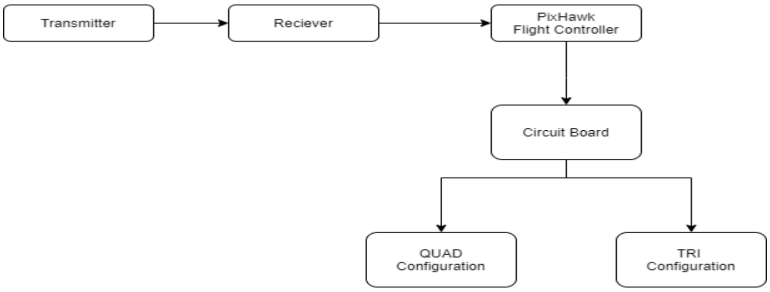

Fig 1: Block Diagram of Implementation

In firmware manipulation, when one of the quadcopter's motors fails, the programming must be changed so that the system seamlessly transitions to tri-mode, for which we will be using the VS code IDE to write the code.

Once this code is complete, we will upload it to the Pixhawk for further testing. Once we get our intended outcome, which is the switching between configurations at the software level, we will release it. We will continue to work on creating external circuits

For designing part, we have to first come up with the logic for successfully carrying out this operation,

Where we will be using RELAYS. At first we will design and implement the circuit externally, where we will be checking it for its reliability, efficiency and robustness.

Now coming to the circuit design to carry out this operation we will be using open source software called EAGLE CAD, EasyEDA. Where we will test and run our circuit and find the best efficient circuit using simulation.

To make the Pixhawk behave like a tricopter, the logic is structured in such a manner that the switching operation from quad to tri is supported by the hardware that is implemented externally on the Pixhawk.

Now the last step will be to implement this circuit with the pixhawk system, where we will be connecting our circuit to the signal port in the pixhawk.

Now coming to the actual working of the project,

First the signal for changing the configuration is sent using the transmitter's dedicated switch.

Then the receiver relays the same signal to the pixhawk.

Once the pixhawk gets this signal it changes its flag to 1 in the code and the ROS changes the configuration and then the circuit is also turned on to carry out this operation. At this stage the drone is working on tricopter configuration state where it will consider only 3 inputs from the motors.

Once the drone is in this state the only goal is to land the drone in a secure and sound manner. The pilot will have very less control over the drone and the drone will respond in a very subtle manner which will help the drone to be stable and take the inputs from the pilot at the same time.

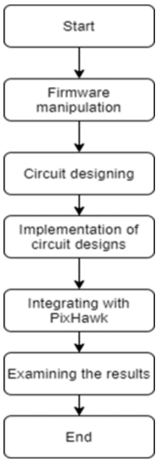

Fig 2: Flowchart for Methodology

Conclusion:

A quad rotor UAV is used as the research platform for the design and implementation of crash avoidance algorithm. Drones are high-priced pieces of equipment used in a variety of sectors for a variety of purposes, and losing drones on a frequent basis can be expensive. The presented methodology tackles this issue by focusing on both software and hardware perspective, in contrast to the existing strategy, which is primarily focused on software. We convert a quadcopter to a tri-copter by developing a system that responds to this situation by altering the drone's configuration via manual signal sent by the pilot and backed by an externally linked circuit to the flight controller. This technique, provides the pilot control over the drone during the fail safe mechanism which switches the configuration to tri-copter, unlike the conventional fail safe systems, which ceases the control from pilots in many occasions. This solution ensures that the drone will do no harm to the surroundings or to itself by landing on the desired coordinates safely.

Scope for future work:

1. Future work may include implementation of crash avoidance system other multi-rotor aircraft, such as hexacopters and octocopters.
2. Automatic motor failure detection.
3. Automatic change of configuration by the pixhawk itself to sustain safe drone flight.