Path and Distance Recoginition in UAV

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***Abstract*— In its present form this research and design report is a result of an investigation into electric unmanned aerial systems for an UAV competition with prolonged flight capabilities. The main focus is on securing embedded systems for unmanned aerial vehicles (UAV). Over the past two decades UAVs have evolved from a primarily military tool into one that is used in many commercial and civil applications. Today they are used in military strikes, weather monitoring, search and rescue missions, and many other fields. . UAVs are flying missions that contain crucial data and without the right protection they can be vulnerable to malicious attacks. To avoid malicious attacks we use different sensor like IR sensor, ultrasonic sensor. Wireless communication is utilized for providing the communication between UAV and the base station. Base station will monitor all the operations when UAV is flying and the changes in the operation can is obtained by the sensors. So we developed the prototype to carry out the operations in UAV.**

***Index Terms*— UAV, IR sensor, Ultrasonic sensor,GPS.**

I.INTRODUCTION

Countries around the globe have become increasingly reliant on unmanned aerial vehicles (UAVs). UAVs are extremely useful in many areas such as the military, civilian, and commercial fields and are a common tool to conduct search and rescue missions. These drones perform missions with high levels of complexity and are useful for cases where a human pilot would face certain risks. They require less human operator participation due to their autonomous behavior. In the case of emergency situations such as natural disasters, UAV systems can be programmed to complete missions from takeoff to landing.UAV is used to find missing hikers in a search and rescue mission. These missions include high navigation precision and long operation times that are tedious for human pilots. UAVs are also much cheaper, faster, and safer than using helicopters for search and rescue mission according to researchers [1]. Historically these drones were primarily used in defense operations but lately they have seen more use in the civilian world. UAVs wide ranges of missions are also used by the Air Force United States Marine Corps, Army, and Navy [2]. The National Defense UAVs represent a variety of missions and technology that range from large vehicles that carry offensive weapons to miniature systems whose components are light and compact to be carried in a backpack. The United States of America is leading the growth and the speed of development of UAV markets. However, understanding the usefulness of UAVs and using mature UAV systems on operational deployment has dramatically improved the growth of UAVs in Europe, Asia, and the Pacific. This, in turn, has generated a steady growth rate in the military field [4]. Many countries are attempting to manufacture drones, but most of them are either technologically unsophisticated or are being used strictly for civilian purposes. The United States and Israel are the two most active manufacturers of military drones with the United States being the largest producer and most frequent user of these systems [5]. The American military now has some 7,000 aerial drones, compared with fewer than 50 some 10 years ago [5]. The Pentagon has asked Congress for nearly $5 billion for drones in the 2012 budget [5]. Many other countries, including Russia and China, have been trying to manufacture deployable drones for a long time but technological difficulties and a lack of accurate intelligence gathering capabilities imposes limits on the effectiveness of their use [5].

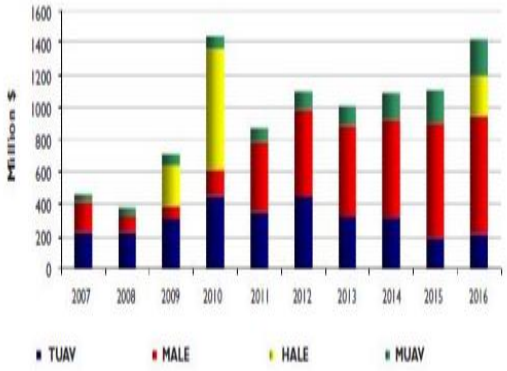

Figure 1:Expected revenue for the different UAV types

The transformation of combat zones abroad and law enforcement at home is considered one of the most important reasons for increased UAV use today. Besides successfully altering the way the military does business, UAVs are becoming powerful tool for civilians. UAVs now are used for commercial applications, including business, photography and environmental monitoring [7]. An example of UAV civilian application is given in Figure 2: A Pteryx UAV is used for aerial photography. UAV drones, aircrafts without human pilots on board, are used today to keep an eye on corporate pollution and to record police tactics at protest locations, which is a big proof of the civilian utilization of UAVs [7].

Figure 2: Pteryx UAV for aerial photography is an example of a UAV civilian application [8].

UAV drones are able to replace human beings for search, guard, and rescue missions. Companies are replacing the human guards by helicopters piloted by a computer for overnight surveillance, which is much cheaper than employing human beings. Likewise, governments from all over the globe recently started deploying drones in areas affected by earthquakes for search and rescue missions [9].

II.PROPOSED WORK

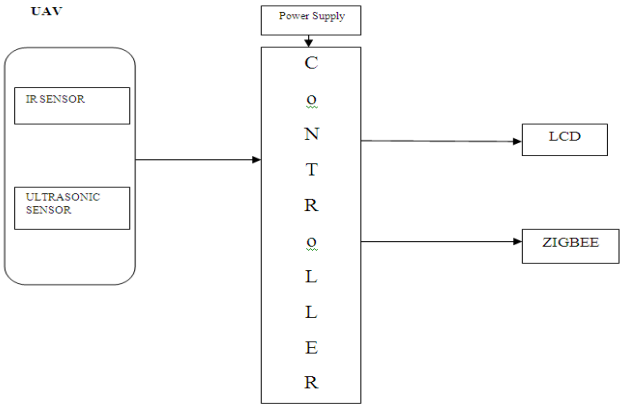

Figure 3:Block diagram of UAV

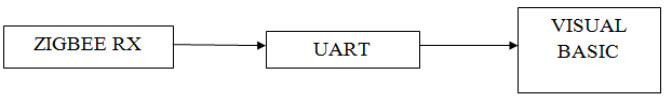

Figure 4: Block diagram for communication

IR SENSOR

An infrared sensor is an electronic device that emits an infrared radiation in order to sense some aspect of its surroundings. Here we are using an active infrared sensor for seat belt detection. The principle behind an active infrared sensor is the transmission and receiving of infrared light. An element known as a light emitting diode (LED) transmits infrared light, which is reflected on the object and received by an optical receiver known as a photo diode (PD). As long as there is no movement or object in the path of the light beam, the light pattern is static and the sensor remains in stand-by. Active infrared sensors are generally immune to the effects of external factors such as rain, snow and falling leaves.

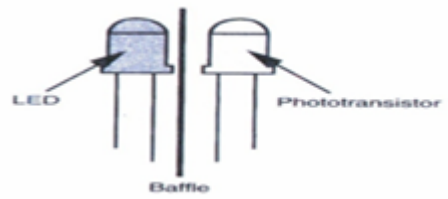

Figure 5: IR Transmitter and receiver

FEATURES

- High accuracy and high sensitivity (110 V/W).
- Low resistance (50 kohm).
- Very good signal-to-noise-ratio.
- Good response time (40 ms).
- Easy and accurate measurement of the sensor temperature.

CIRCUIT DIAGRAM

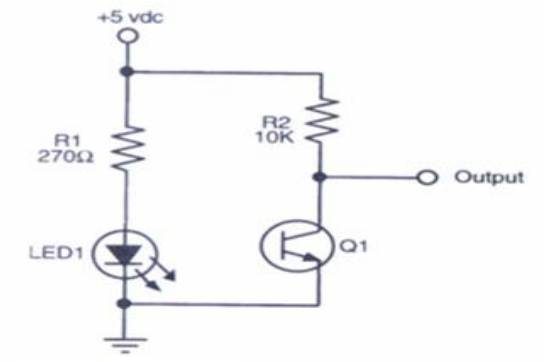

Figure 6: Circuit diagram of IR sensor

WORKING

IR LED emits an infrared radiation. This radiation illuminates the surface in front of LED and reflects the infrared light. Depending on reflectivity of the surface, amount of light reflected varies. This reflected light is made incident on reverse biased IR sensor. When photons are incident on reverse biased junction of this diode, electron-hole pairs are generated, which results in reverse leakage current. Amount of electron-hole pairs generated depends on intensity of incident IR radiation. More intense radiation results in more reverse leakage current. This current can be passed through a resistor so as to get proportional voltage. Thus as intensity of incident rays varies, voltage across resistor will vary accordingly. This voltage can then be given to OPAMP based comparator. Output of the comparator can be read by microcontroller.

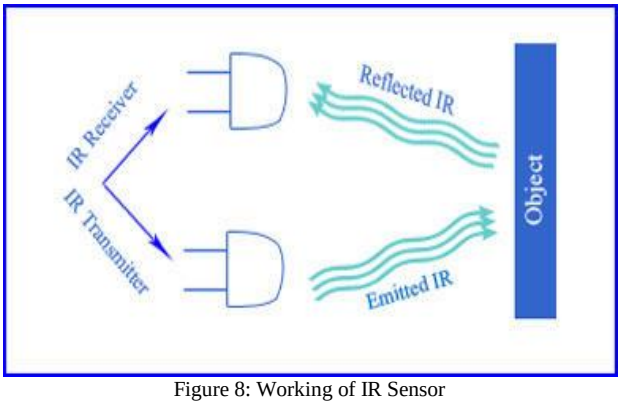

Figure 8: Working of IR Sensor

APPLICATIONS

- Augmentative communication devices.
- Door locking systems.
- Computers.
- Emergency response systems.
- Environmental control systems.
- Headphones.
- Home security systems.
- Navigation systems.
- Telephones, compact disk players, stereos.

ULTRASONIC SENSOR

Ultrasonic sensors also known as transceivers when they both send and receive, but more generally called transducers work on a principle similar to radar or sonar, which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Active ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. Passive ultrasonic sensors are basically microphones that detect ultrasonic noise that is present under certain conditions.

Ultrasonic sensors use sound waves rather than light, making them ideal for stable detection of uneven surfaces, liquids, clear objects, and objects in dirty environments. These sensors work well for applications that require precise measurements between stationary and moving objects. Ultrasonic Sensors are interchangeable, suitable for both transmit and receive. Excellent performance specifications and reliable life-time performance. Ideal for use in alarm systems and object detection. It is suitable for dual use, with high performance characteristics. Standard operating frequency and good sensitivity. Ideal for use in range measurements, robot applications, alarm sensors, etc.

Figure 9:Ultrasonic Sensor

FEATURES

- Ideal for use in Beam Detection Systems
- Sensitivity: >-65dB
- Nominal Frequency: 40kHz
- Maximum Driving Voltage: 20Vrms
- Operating Temperature: -20oC to +70oC
- Dimensions: 16.2mm Diameter, 12.2mm High excluding pins, Pins - 10mm High

WORKING

Ultrasonic sensors work by transmitting energy in the form of ultrasonic waves to a target object, which reflects the waves back to the sensing head. Ultrasonic sensors are largely used in measuring distances based on the time it takes for the wave transmission and reception to be completed. The energy transmitted by an ultrasonic sensor to an object comes in the form of ultrasound, which is a sound wave above what the human ear can perceive. Ultrasounds are generated by an ultrasonic transducer that transmits ultrasonic waves coming from mechanical energy produced by air blowing.

A basic ultrasonic sensor is composed of a transmitter and a receiver. There are two general types of ultrasonic sensors, differing only in the material used to generate the wave. The first is a piezoelectric sensor, which generates ultrasonic waves through piezoelectric quartz crystals or ceramics. The second is an electrostatic sensor, which makes use of a micro-thin metallic membrane.

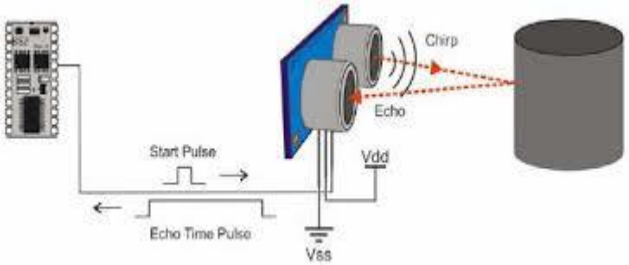

Figure 10: Circuit Diagram for Ultrasonic Sensor

ADVANTAGES

- An ultrasonic sensor is response is not dependent upon the surface colour or optical reflectivity of the object. For example, the sensing of a clear glass plate, a brown pottery plate, a white plastic plate, and a shiny aluminium plate is the same.
- Ultrasonic sensors with digital (ON/ OFF) outputs have excellent repeat sensing accuracy. It is

possible to ignore immediate background objects, even at long sensing distances because switching hysteresis is relatively low.

- The response of analog ultrasonic sensors is linear with distance. By interfacing the sensor to an LED display, it is possible to have a visual indication of target distance. This makes ultrasonic sensors ideal for level monitoring or linear motion monitoring applications.

GPS

The GPS system concept is based on time. The satellites carry atomic clocks which are synchronized and very stable; any drift from true time maintained on the ground is corrected daily. Likewise, the satellite locations are monitored precisely. User receivers have clocks as well. However, they are not synchronized with true time, and are less stable. GPS satellites transmit data continuously which contains their current time and position. A GPS receiver listens to multiple satellites and solves equations to determine the exact position of the receiver and its deviation from true time. At a minimum, four satellites must be in view of the receiver in order to compute four unknown quantities.

Figure 11: GPS

WORKING

GPS aircraft tracking solution needs a device embedded in the aircraft and made of a GPS sensor. It transmits in real time or not the GPS position received on board to a server on ground via a communication network. The server collects the data. Data received on ground can be recorded and/or used to display the aircraft real time position. Different kinds of communication networks are used to transmit data on ground:

- ACARS network which is a hybrid of VHF, Satellite and HF networks
- Transponder "Mode S" (ADS-B) network
- Satellite network
  (Globalstar, Inmarsat, IRIDIUM, Thuraya)
- GSM network

Devices installed in the aircraft are avionics components like ACARS, ADS-B or other solutions. In these cases, the receiving and transmitting antenna are usually located outside of the airframe.

When devices are not installed as avionics components they have to be completely independent from the aircraft. They are typically placed in the aircraft airframe in a location where the GPS and communication satellites are directly visible to the device, for example through the cockpit window. The output signal must also be able to go through the aircraft - most Civil Aviation Authorities require compliance with DO-160 for Audio Frequency Conducted Susceptibility and Induced Signal Susceptibility.

FEATURES

Commercial aviation applications include GPS devices that calculate location and feed that information to large multi-input navigational computers for autopilot, course information and correction displays to the pilots, and course tracking and recording devices.

ADVANTAGES

GPS is extremely easy to navigate as it tells you to the direction for each turns you take or you have to take to reach to your destination.

- GPS works in all weather so you need not to worry of the climate as in other navigating devices.
- The GPS costs you very low in comparison other navigation systems.
- The most attractive feature of this system is its 100% coverage on the planet.
- It also helps you to search the nearby restaurants, hotels and gas stations and is very useful for a new place.
- Due to its low cost, it is very easy to integrate into other technologies like cell phone.
- The system is updated regularly by the US government and hence is very advance.
- This is the best navigating system in water as in larger water bodies we are often misled due to lack of proper directions.

III.CONCLUSION

Over the course of this project, much was learned regarding modern-day UAVs and security of their computer architecture. UAVs consist of multiple modules that are each responsible for performing a different function. All of these must be programmed to fit together to ensure that the UAV is fully functional and completes all of its tasks properly. Sizing is also a very important factor in the design of UAV platforms. Since these planes are unmanned, they are typically smaller than most man-flown aircraft. While some military- grade planes can carry a big payload, most are used for civil uses and have limited size, space, and power capacity. For this reason one must be careful when designing a platform so that they do not exceed the limitations of the actual aircraft.

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