Emergency gas and fire detection using quadcopter

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project/internship titled **"Emergency gas and fire detection using quadcopter"**, submitted by Tanvirul Ehsan ID: -171-15-9211, Oailur Rahamn ID: -171-15-8989, Karimuddin Rony ID: -171-15-8948 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 02-06-2021

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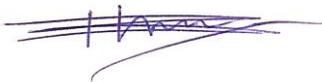
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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Dr. Touhid Bhuiyan, Professor & Former Head, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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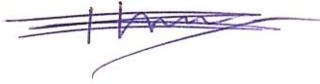
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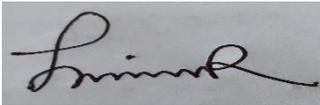
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ABSTRACT

Today is the era of technology and the magic of innovation is spreading day by day. People are unlocking newer achievements by using technology. Quad copter (Drone) is one of them. This innovative device is using significantly by human in their various kinds of works and thus it's becoming beneficial day by day. Besides military purpose, delivery system, agricultural farming, medicine, photography, emergency rescue they are being used in the risky Industrial areas also where human access is so difficult and harmful. In Bangladesh, fire incidents occurred by gas and electricity leakage are increasing simultaneously. For that purpose, we have proposed a Quad-copter for early detection of flames, gas, air monitoring (optical dust sensor) and designing a custom frame. Adding that our proposed model will also work on industrial area survey and will try to find out the shortage and leakage spots. The Quad copter will also send SMS or call to Smart phones containing the message of detection gas or fire monitoring the Indoor Air Quality (IAQ), occupational health and safety of (industrial) workplace. Our model is embedded with MQ-135 Gas Sensor, five-way flame Sensors, optical dust sensor etc. We will be explained the whole design, implementation process and benefit of our model during the whole work.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

In these days, people usually think that the usage of quad copters are limited to military surveillance, research, delivery systems, and search and in rescue operations and as well in security purposes. But, besides all of these, the device can have been unquestionably greater massive quantity of uses than the ones. Surely, they've a miles extra giant utilization.

There is industrial quad-copters that have been offered on the marketplace nowadays as well as can possibly be utilized for lots of kinds of selection functions. That is not all; there are a big variety of Unmanned Airborne Cars (UAVs) stacked with features. These flying gadgets can be discovered in their applications in our daily life in different areas of our life. They are only ground-breaking devices and can be regulated in remote locations.

One of the most fantastic applications of UAVs are the capturing of live events like sports, shows, movie scenes, natures etc. Quad copters do a great job by taking a stunning view of the natures from a distant location. In previous days, people basically used cameras of cables capturing aeronautical perspectives. They only could be moved using a straight cable. The quad copters have managed to rescue us from those tough days by delivering a free-flying item that can move towards any path we want. During enjoying any live events we can see the little flying items right in front of the stages which are nothing but four-rotor blade drones that carry cameras and capture amazing footages. Drones are also used in Journalism sectors for revealing mishaps and calamities by providing visual insights of the situations.

Farmers all over the world are consistently endeavoring to diminish the costs and grow yields. Using drones, horticultural workers can assemble data, convert redundant processes to largely automatic operation and can enhance efficiency. Seed planting can be done by using drone nowadays which is a task easier dispersal.

In Real Estate fields, drones can record the shots of the properties that are to be sold. In Construction areas, the utilization of drones sets aside cash and time on accessing

specialized equipment. Also, these inspectors can avoid risks related to safety as the inspection is to be carried out at high levels.

We have engineered a quad copter for assisting the fire brigades to know the inside-edge situation conforming the gas and fire leakages.

1.2 Objective

Objectives are things aimed at or sought, actually a goal. Our proposed model was aimed at the followings:

- To know the fire and gas leakage spots from the fire occurred places.
- To be informed about the optical dust particles present in that fire environment.
- To be careful from the unwanted fire and gas accidents during industrial place survey.
- To reduce the damages caused by fire.
- To alert by sending SMS to the operator and as well as fire stations.

1.3 Motivation

The motivation behind our work were-

- According to the news of March 23, 2021 covering by 'NEWAGE Bangladesh', "One in five fire accidents linked to gas leakage."
- Fire solution information reveal that they reported 16,858 fire mishaps in 2016, while the number was 24,074 in 2019, which revealed practically 50 percent enhance in fire mishaps.
- The information likewise programs that Mishaps from gas leakages likewise leaped from 3,447 in 2016 to 4,428 in 2019.
- From the statistics we can know that the explosions are occurred by gas leakage and due to the dust particles present in those environments.
- All of these inspired us to make a device like quad copter which will help us informing the situations and from them we can be aware of fire incidents.

1.4 Expected Outcome

The output of our proposed work is -

- Our Proposed model will detect fire and gas leakage spots from the fire occurred places.
- The device will also make sure about the dust particles present in the industrial environment.
- The architecture will aware us from the unwanted fire and gas accidents during industrial place survey.
- The quad copter will send SMS to the operator and as well as fire stations.
- It will also reduce the damages caused by fire.
- The device will reduce the risk of fire accidents and gas explosion.

1.5 Rationale of the study

In this era of Innovative technology, drone has become a popular device to make our everyday work easier comparing as before. Quad copters (aka Drones) are being used in many sectors of the world. Besides all of that use, this device is being utilized in rescue operations in the fire accident spots. They can be used to detect emergency gas and fire situations where human access is so risky and difficult. Our device will send SMS or use call function to inform the user or fire brigades about the inside situation that will help the fire stations.

1.6 Project Management and Finance

For every research or project, financial support is much important. The cost estimation for our Project is listed below-

SL. No.	Product Name	Quantity	Rate	Price
1.	K.K.2.1.5 Flight Controller	1	1400	1400

No.	Component	Quantity	Unit Price	Total
2.	Arduino Mega 2560	1	700	700
3.	Emax ESC 30A	4	650	2600
4.	Emax Brushless Motor 1400KV	4	650	2600
5.	S-500 Frame Kit	1	1800	1800
6.	2200mAh Battery 11.1V	1	1300	1300
7.	B-3 Pro Charger	1	350	350
8.	8045 Propeller	2 Pair = 4	100	200
9.	Fx-i6 Controller	1	3600	3600
10.	Optical Dust Sensor	1	450	450
11.	MQ-135 Gas Sensor	1	140	140
12.	Five-way Flame	1	350	350
13.	9Y Heat sink Tube	1	180	180
14.	GSM Module 900A	1	800	800
15.	3.7V 4300mAh Rechargeable Battery	3	50	150
16.	3.7V Charger	1	150	150
17.	18650 3X Case	1	45	45
18.	XT-60 Connector	1 pair	25	25
19.	Bullet Connector	25	15	375
20.	NK Potentiometer	1	10	10

Though the project looks much expensive, but comparing with other drones manufactured by famous companies is quite low budget.

1.7   Report Layout

Chapter 1 describes the Introduction, Motivation, objectives, expected outcomes, Project management and finance and also about the Report Layout.

Chapter 2 provides the Background containing the explanation about the Preliminaries/Terminologies, Related works, comparative Analysis and Challenges.

Chapter 3 depicts the Requirement Specification of parts, Quadcopter basis. Quadcopter materials, additional sensors and its characteristic

Chapter 4 gives overall Design and details of working and connection the parts and results

Chapter 5 concludes by providing discussion and scope of further developments in future.

CHAPTER 2

BACKGROUND

2.1 Preliminaries/Terminologies

From recent statistics (year of 2019) there can be seen that a record number (24,074) of fire incidents occurred last year in Bangladesh and a huge amount of money (around 330cr) was lost by those incidents.
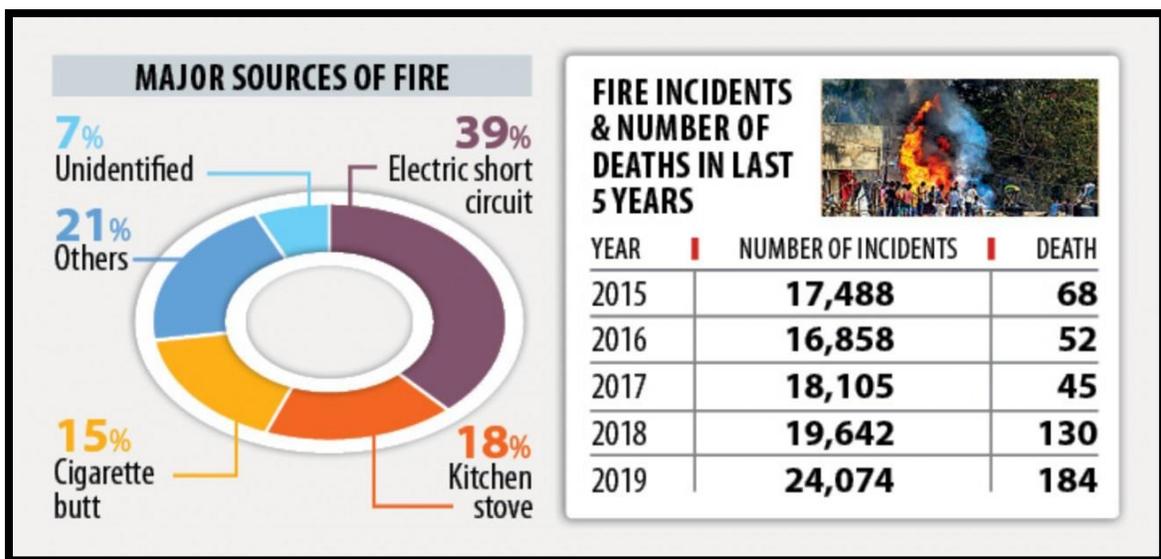
Figure 2.1: Major Sources of Fire.

Investigating the major sources of fire there have been seen that 39% incidents were happened by electric short circuit, 18% from Kitchen Gas stoves, 15% from Cigarette butt, 21% from others and 7% were unidentified.

That Federal government record programs that Fire events throughout the nation increased by 22.5 percent to 24,074 in 2015 (2019), compared with 19,642 in 2018, triggering a loss of Taka 330.41 core.

One-third of the fire events - 8,466 - happened at homes primarily because of electric brief circuit and gas leakages, information revealed by Bangladesh Fire Solution and Civil Support.

Fast urbanization and negligent use digital devices and gas cynical tubes are amongst the significant factors behind the increase in fire events, stated by the authorities. And they have likewise stressed out the require of increasing understanding amongst people to avoid the duplicate the events.

2.2   Related Works

The works we have followed to do our job have been explained below-

Abhijit et al. (2020), [1] made A smart semi-autonomous fire extinguish quad copter that can manage difficult and dangerous tasks and its efficient performances enable it to be used in fire-related problems, such as reaching and exploring catastrophic zones. The UAV is intended to operate while holding a fire extinguisher. The adverse consequences of fire breakouts or fire on buildings or elsewhere present a significant danger to our lives.

By using that quad copter as well as how people can be rescued from the smoke of the fire, because of the smoke of the fire, people can't breathe, causing death.

Abhijit et alia. (2020), [1] made A clever semi-autonomous fire extinguisher quadcopter that can possibly handle challenging and hazardous jobs and its reliable efficiencies make it possible for it to be made use of in fire-related issues, such as getting to and discovering devastating areas. The UAV is planned to run while holding a fire extinguisher. The unfavorable repercussions of fire outbreaks or fire on structures or somewhere else offer a considerable risk to our lives.

Using that quadcopter in addition to exactly how individuals can possibly be rescued from the smoke of the fire, due to the smoke of the fire, individuals cannot take a breath, triggering fatality.

Nadia et a1. (2018), [2] has style a whole configuration contains Arduino Uno, MPU-6050 3 Axis Gyro, prop, Li-poly battery, quadcopter mount with touchdown sets, RC Receiver, brushless electric motor, 30A ESC, RC Transmitter with FS-iA6 Receiver, 555Timer IC, DC electric motor, copper coil, fire sensing unit, and buzzer. The Quadcopter has several

attributes like an onboard electronic camera center, computer system vision to track a relocating item, and a controller with a Wi-Fi or GPS monitoring center.

Goodall et a1. (2020), [3] explored a massive air pollution removal to eliminate contaminants that are currently around in the atmosphere. The E-drone flies approximately a fixed elevation every step the air contaminants at that place, applies on-board air pollution abatement remedies for contaminants over the advised limit, then flies pull back to its place on the ground. The benefits of this system are its capability to determine air pollution focus of CO_2, CO, NH_3, SO_2, PM, O_3, and NO_2, discover when they are expensive, and execute on-board air pollution abatement remedies as required. This system's uniqueness hinges on that it not just spots when there's too much air pollution however additionally instantly manages and moderates the identified air air pollution over the planet.

AB Muqeet et a1. (2019), [4] suggested a pattern of drone or an unmanned airborne automobile that has the ability to efficiently and successfully discover, evaluate and check contaminants airborne in the atmosphere, and the various other function of the research is to construct air pollution tracking systems that are small in measurements. It is additionally able to determine criteria of air pollution such as PM10, PM 2.5. They made use of a kind of air pollution sensing unit and the setting of the sensing units on the UAV and offered a tool to know the adjustments in air pollution criteria as the UAV can possibly be openly maneuvered in the facility. The UAV hovered at different sights in the city and the degree of air pollution was recognized in real-time.

Alexander Bernard (arb392), [5] has explained the 'Target Tracking' function of an Autonomous Quad-copter through an article. His goal was to drive the quad copter continuously follow the hover directly above the target as a predetermined height.

2.3   Comparative Analysis and Summary

There are four main quad copter controls:

- Roll
- Pitch
- Yaw

- Throttle
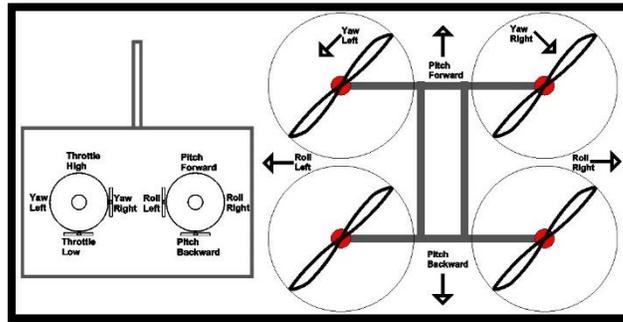
Figure 2:1Simple sketch of roll, pitch, yaw, and throttle on a transmitter (left image) and quad copter (right image).

2.4   Challenges

The primary difficulties for the making quad copter are selection parts about quad copter. We have not enough knowledge about selection the parts. We study hard and hard then we gather knowledge. Then the digester comes in our country covid-19 virus. We can't gather parts from anywhere because of shortages in market .and the prices are increasing so high and we are affected to maintain out costs to make this project.

CHAPTER 3

Requirement of Components

3.1   Requirement of Components

Quad-Copter is a type of Aerial Vehicle that has a large potential for performing tasks that are not easy for humans. It is also called UAV (Unmanned Aerial Vehicle). Examples: Monitoring wildlife, Defense system, an inspection of high structure construction, firefighting and human rescue, Agriculture field monitoring, transporting medicine, tourism, and hospitality, cinematography or videography, assisting search and rescue team. It is very useful for this purpose. Over a final couple of years, our experts have actually viewed an enhanced every day in the produce and also purchases of remote-control airborne cars like as Quad-Copter. This airborne lorry has actually 4 arms and also taken care of sound props which are actually embedded in an "X" or even "+" icon. There's no bodily relationship in between the atmosphere and also the Quad-Copter and also no collaboration in between the Quad-Copters if will have actually the functionalities to work together the lot of options expands also potential [3]. As an example, a team of Drone will manage to properly and also autonomously hunt a overlooking individual in a huge region.

[6] Through shearing records in between. Or even, the integrated lot's ability of a team of Quad-Copters may utilize to provide medication in remote control regions. This research study is actually intended for making a real-time cordless Quad-Copter that's suitable for the hunt and also videography. Beginning along with placement command, added operator reasoning could be carried out to counteract the requirements enforced through mass linked to the Quad-Copter.

3.2   Drones and Basic

The concept of any sort of drone can easily feature various blades along with various moving wings inning accordance with our need. Those various electric motors can easily cause take activity and also drive activity including various action. Our experts have actually concerted a Quad copter, possessing 4 electric motors along with 4 moving wings. The left behind and also appropriate generate take activity, while the main and also rear generate drive activity[10].

A microcontroller panel may be referred to as the human brain of the robotic. These panels are actually being actually created in such technique to ensure that the drone may be automobile piloted.

Making everything pilot, the value has to harmony to creating an equal pressure (Raise) as well as harmony seconds around its own center of mass through creating contrary seconds. By utilizing 4 blades a quad copter creates the called for seconds and also raises pressure.

3.2.1 Multirotor Coordinate System:

While going over the piloting and also multirotor building and development, a certain method of discussion is actually demanded distinct actions of the multirotor. In 1700s mathematicians defined the alignment of stringent our body systems precede. Coming from certainly there certainly they have actually designed a maker the spot a collection of 3 slants has actually being actually detailed, within this particular instance[8], for the alignment of the multirotor 3 various sizes are actually being actually made use of. These 3 sizes or even slants are actually considered roll, sound, and also yaw.

- While going over the piloting and also multirotor building and development, a
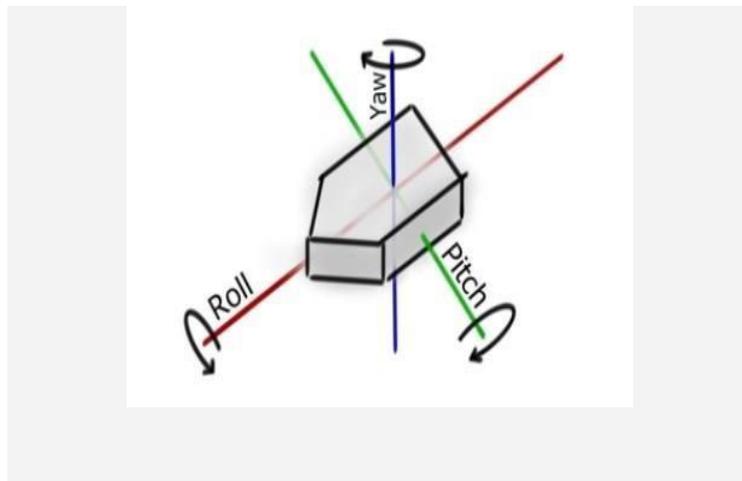
Figure 3:1 Orientation of quad-copter roll, pitch and yaw

certain method of discussion is actually demanded distinct actions of the multirotor. In the 1700s mathematicians the quadcopter can easily turn side-by-side as well as this could be defined due to the roll angle of the multirotor[8]. If our team turns our head in the direction of among your shoulders the turning of the quadcopter around

the roll axis is actually the exact very same. This rolling of the multirotor induces it to relocate laterally.

- The ahead as well as back action of the quadcopter is actually being actually induced for the sound angle of the multirotor. When our team turns our head if you want to seek out or even down these actions are actually like turning around the sound axis[11]. As the multirotor throwing leading to it to relocate ahead or even back.

- The yaw angle of the multirotor can easily capable to explain the birthing, or even, simply put, turning of the craft as it remains degree to the ground. When our team trembles our visit mention "no." this certain action is actually the yaw action of the quadcopter[15]. The last term that defines the alignment of a quadcopter is actually, strangle of the multirotor. The elevation of the multirotor is actually being actually regulated through strangling.

3.2.2 The physics of flight:

While flying our quadcopter, it is actually crucial to know the motion of the multirotor as well as exactly how it may be command wonderfully. The rotational velocity of the electric motors creates various actions of multirotor. The proper way is actually to readjust the family member rates of the electric motors, bearing in mind that the rotational velocity of the electric motors calculates just the amount of raise each prop creates[16].

3.2.3 Roll and pitch:

the trip operator creates the electric motors to twist quicker on one edge of the multirotor compared to the electric motors beyond triggering the multirotor to turn around the roll or even sound axes, through significance one edge of the multirotor will certainly need to raise greater than the opposite, triggering the multirotor to turn. Therefore, for instance, to create a quadcopter to roll appropriate or even turn around the roll axis clockwise, the trip operator will certainly command the motion of 2 electric motors left wing edge of the multirotor to twist quicker compared to both electric motors on the appropriate edge. The left behind edge of the quadcopter will certainly after that have actually more raise

compared to the appropriate edge, triggering the multirotor to turn. Likewise, to create a quadcopter sound down, that's turn around the sound axis clockwise, currently the trip operator will certainly perform the contrary[8]. It will certainly create both electric motors on the rear of the quadcopter to twist quicker compared to both electric motors on the main, creating the craft to turn similarly when our head tilts as our team appearance down.
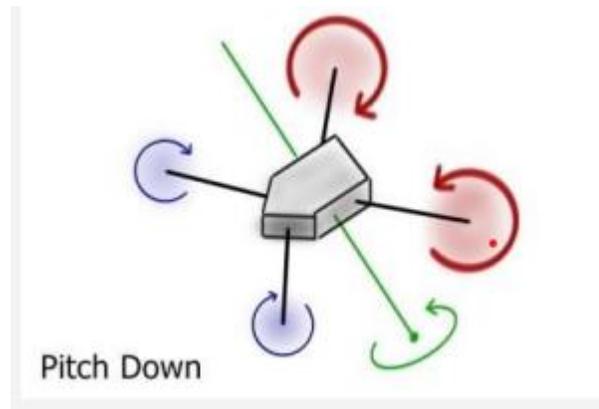

Figure 3:2 Quad-copters pitch up and down by adjusting the relative speeds of the front and back motors
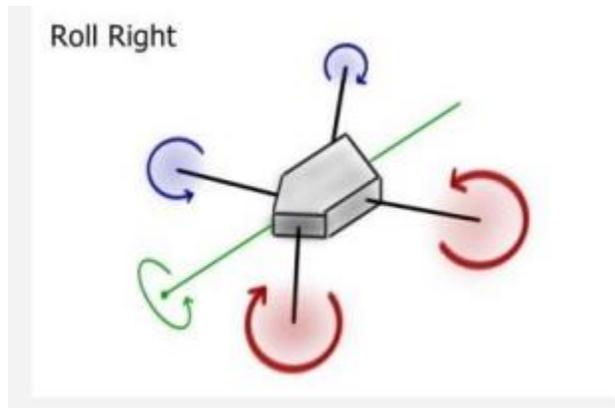
Figure 3:3Quad-copters pitch up and down by adjusting the relative speeds of the front and back motors

3.2.4 Yaw:

Managing the multi-rotor's turning around the roll or even sound axes is actually simple however the complicated job will certainly be actually the yaw axis. Very initial, allow our team talk about exactly how we'll have the ability to avoid turning around the yaw axis. When constructing as well as programs multirotor, our team has actually configuration the electric motors in such method therefore that each electric motor rotates in the contrary instructions compared to its own next-door neighbors[4]. Simply put, utilizing a quadcopter as an instance once more, if our team begins with the front-left electric motor, it is actually relocating clockwise, the motors' rotational instructions can easily option, CW, CCW, CW, CCW. To reduce the effects of, or even terminate out one another or even motor's propensity to turn the multirotor our team have actually utilized this rotational setup

When a prop rotates, for instance, in clockwise turning, the multirotor will certainly tend to twist counter-clockwise inning accordance with the preservation of angular energy. This is because of Newton's 3rd legislation of movement, "for each activity, there's an equivalent as well as contrary response." The body system of the multirotor will certainly constantly have the tendency to twist on the contrary instructions compared to the rotational instructions of the props[5].
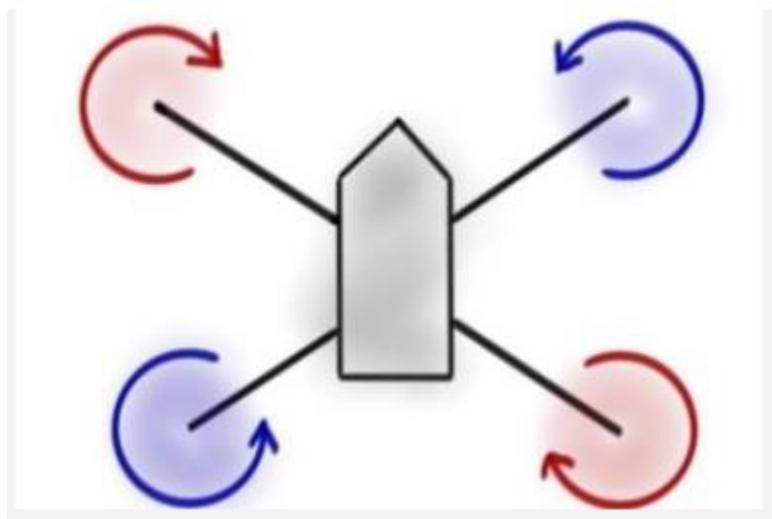
Figure 3:41 configure of each motor to spin in the opposite direction than its

When a prop rotates, for instance, in clockwise turning, the multirotor will certainly tend to twist counter-clockwise inning accordance with the preservation of angular energy. This is because of Newton's 3rd legislation of movement, "for each activity, there's an equivalent as well as contrary response." The body system of the multirotor will certainly constantly have the tendency to twist on the contrary instructions compared to the rotational instructions of the props[9].

3.2.5 Altitude Control:

Since our team comprehend guiding concept of the multirotor, allow our team rapidly talk about a a lot easier phrase, which is actually hovering. To create the quadcopter or even multirotor hover, which implies it will certainly remain at a continuous elevation without turning at every other instructions. For this motion, an equilibrium of requires is actually needed. When the raise is actually created due to the blades the trip operator will certainly need to counteract the pressure of gravitation. Therefore our team can easily state that the mass of the multirotor opportunities gravitational velocity amounts to the pressure of gravitation acting upon the multirotor. The raise created due to the multirotor amounts to the amount of the raise created through each of its own blades. For that reason, to preserve a continuous elevation the pressure of gravitation needs to be actually equivalent to the pressure of the raise created due to the electric motors. To rise or even come down, for that reason, the trip operator interrupts this equilibrium. The craft will certainly increase elevation if the raise created due to the multirotor is actually higher than the pressure of gravitation[6]. If the contrary holds true, the multirotor will certainly drop when the raise created due to the multirotor is actually lower than the pressure of gravitation acting upon the multirotor.

3.2.6 Movement:

Therefore, as for our team have actually talked about exactly how, through changing the family member rates of the several electric motors, the trip operator can easily turn the multirotor in lots of instructions[6]. Effectively, the primary factor our team have the ability to relocate the quadcopter is actually the turning of the multirotor. Through turning the

multirotor in various instructions, it could be created to progress, backward, left behind, or even appropriate. For instance, it progresses when the multirotor pitches down (clockwise about the sound axis). The factor the multirotor relocations when it tilts, a few of the raise created due to the blades is actually administered flat while typically every one of the raise is actually administered down. It presses the multirotor because of laterally element of the raise. Currently can easily state that our team are actually compromise a few of the multirotor down drive to relocate the craft flat. While moving multirotor have the tendency to shed elevation because of much less drive is actually administered down while the multirotor is actually turning. Some trip controllers have actually a function referred to as "elevation keep" which implies the trip operator have actually its own very personal ability that immediately changes the electric motor rates so as to create the craft preserve a continuous elevation while its own relocate

Currently our team are actually utilizing, Quadcopter is actually one of the absolute most prominent multirotor due to its own framework, form, ability, security as well as simplicity of command. Quadcopter have actually 4 electric motors, the form could be specifying as X setup or even Y4 setup. Mechanically is actually easier that tri-copter. Because of 4 electric motor they can easily raise greater value compared to tri copter[11]. The quadcopter is actually a lot steadier capable remain air-borne for much a lot longer duration. Cheaper compared to octa or even Penta copter. Trip opportunity depends upon style inning accordance with demand. Additionally, in regard to command it is actually rather simpler.

3.3   Quad-Copter Material

3.3.1   KK2.1.5 flight controller:

KK2.1.5 Multi-Rotor operator is actually a trip command panel for multi-rotor airplane (Tri-copters, Quadcopters, Hex-copters and so on.). Its own function is actually to support the airplane throughout trip. To perform this, it takes the indicator coming from the 6050MPU gyro/acc (roll, sound as well as yaw) after that passes the indicator to the Atmega644PA IC. The Atmega644PA IC system after those procedures these indicators depending on the individuals chosen firmware as well as passes command indicators to the set up Digital Rate Controllers (ESCs). These indicators instruct the ESCs to create great

modifications to the electric motors rotational rate which consequently stabilizes your multi-rotor craft[7].

KK2.1.5 Multi-Rotor command panel likewise utilizes indicators coming from your broadcast bodies recipient (Rx) as well as passes these indicators to the Atmega644PA IC through the aileron, lift, strangle as well as tail inputs. When this info was refined the IC will certainly send out differing indicators to the ESCs which consequently change the rotational rate of each electric motor to cause managed trip (up, down, back, ahead, left behind, appropriate, yaw).

KK2.1.5 flight controller implement has been very effectively in the so many airplanes. Issue designer location control easily user can such as

1. Use
2. Configure
3. Search
4. Recuse
5. Program
6. Simulate
7. Surveying areas

Apply of the KK2.1.5 flight controller:

1. Helicopters
2. Ground rovers
3. Boats
4. Submarines
5. Multirotor Drone
6. Pusher.
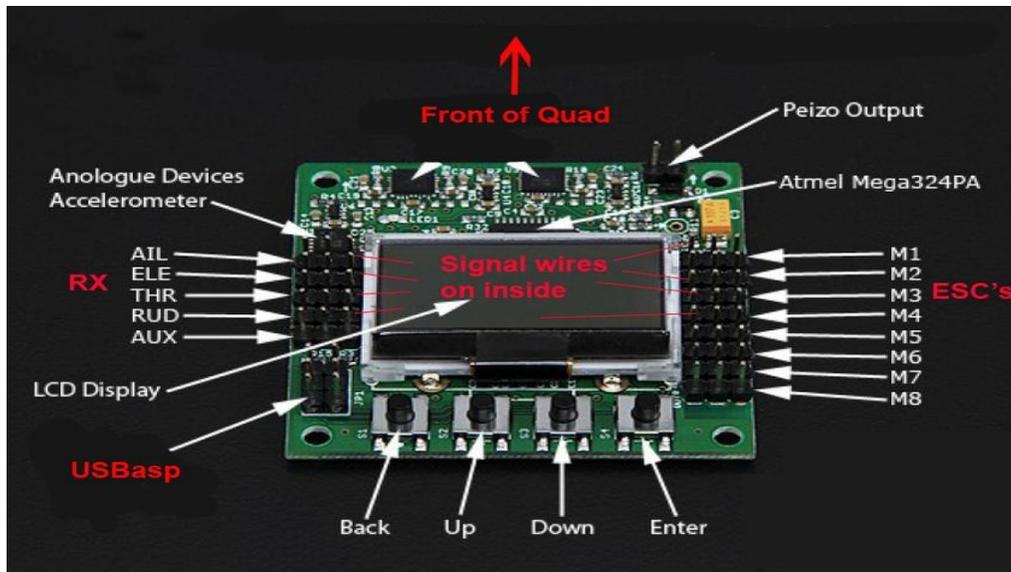
Figure 3:5 KK2.1.5 flight controller pin diagram

Specification:

- Size: fifty.5mm x fifty.5mm x 12mm
- Weight: 21 grams (Inc Piezo buzzer)
- IC: Atmega644 PA
- Gyro/Acc: 6050MPU Intenseness Inc.
- Auto-level: Indeed
- Input Voltage: 4.8-6.0V
- AVR user interface: requirement 6 affix.
- Signal coming from Recipient: 1520us (5 channels)
- Signal to ESC: 1520us

3.3.2 11.1V LIPO Battery (Wild Scorpion 2200mAh 3S Battery)

Specification:

1. Battery capacity: 2200mAh

2.Continuous Discharge Rate: 30C

3.Max Discharge Rate: 40C

4.Battery section: 3S (11.1V)

5.Cell Unit: 3 Cells

6.Weight: Approx. 190g

7.Charge Plug: JST-XH

8.Discharge Plug: JST

9.Rechargeable Battery 10.Dimension: 23.5 x 35 x 68 mm

Figure 3:611.1 LIPO Battery

3.3.3 S500 Glass Fiber Quadcopter Frame:

Features:

• Developed coming from high top premium glass fiber as well as polyamide nylon material

• Pre-threaded metal sleeves for all of framework screws

• Situating buttons for arms

• Tinted arms for positioning to assist you to always keep taking flight in the appropriate instructions

• PDB for simple as well as cool electrical circuitry

Specification:

1. Motor centers: 480mm
2. Height: 170mm
3. Weight: 425g (frame only)
4. Motor Mount Bolt Holes: 16~19~25mm

Required:

I. 4 x 9×4.7~10×5 props
II. motorzx 18~30A speed controllers
III. x 28mm 800~1000KV
IV. 1 x multi-rotor control board
V. 1 x 2200mah 3S 11.1V to Li-Poly battery or more.
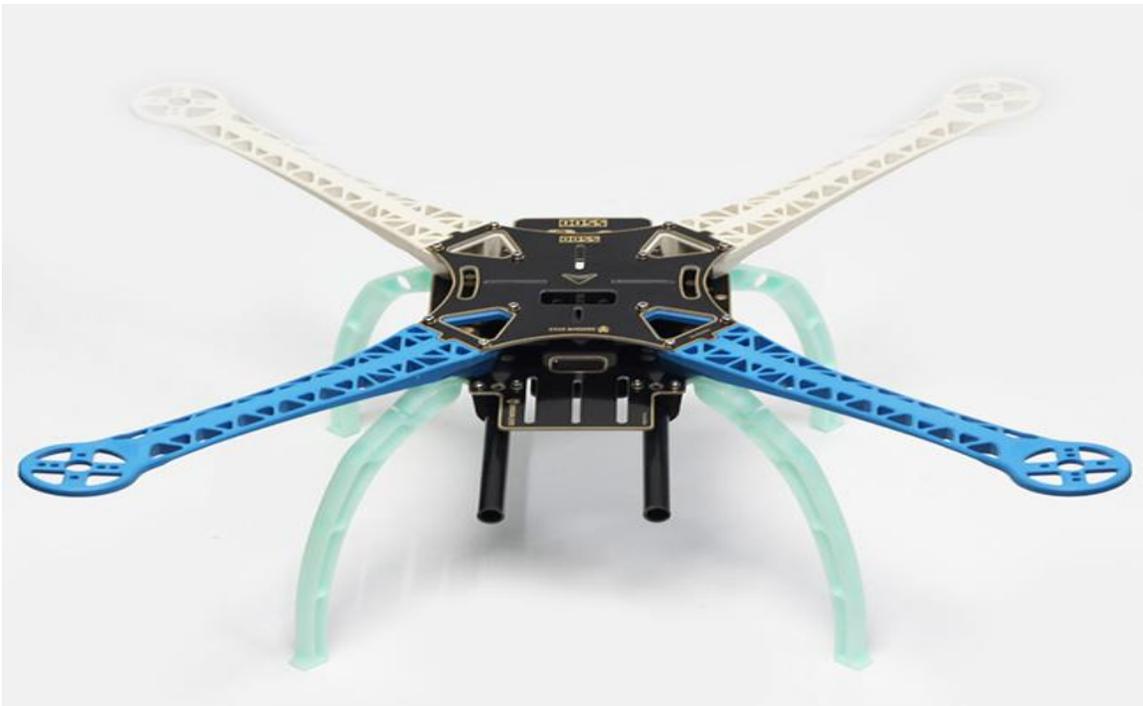
Figure 3:7 S500 Glass Fiber Quadcopter Frame

3.3.4 Emax XA2212-980kv Outrunner Brushless Motor:

- Value: 1.8 ounces. (52 grams)
- Diameter: 1.1 ins (28.5mm)
- Length: 1.7 ins (30.5mm)
- Exposed Ray: 1/8″ x 7/16″ (3.0mm x 11.1mm)
- Voltage: 7.2 - thirteen

Figure 3:8 E-max   XA2212-980kv Out-runner Brushless Motor

- Optimum of 15 Amps for 30 Sec
- KV: 980
- Mounting openings are actually spaced 16mm as well as 19mm on facility as well as are actually touched for 3.0mm screws.

Specifications:

- KV: 1400
- No tons Present: 10 V: 0.5A.
- Present Capability: 12A/60s
- No Tons Present @ 10V: 0.5A
- Ray size: 3.175mm.
- Minimal ESC Spec: 18A (30A Recommended)
- Drive @ 3S along with 8045
- prop: 800gms approx.
- No. Of Tissues: 2-3 Li-Poly

3.3.5 EMAX BL-Heli Series 30A ESC:

A digital rate operator or even ESC is actually a gadget set up to a remote-controlled electric design to differ its own motor's rate as well as instructions. It has to connected into the receiver's strangle command network.

Figure 3:9EMAX BL-Heli Series 30A ESC

EMAX BLHELI SERIES 30A ESC is actually a brushless dc electric motor rate operator. The reduced outcome protection significantly improves the energy security, as well as this will certainly enhance the fantastic electric battery lifestyle[16]. The EMAX BLHELI SERIES 30A ESC is actually configured to begin the brushless dc electric motor. This ESC has actually a higher present dealing with capability which is actually 30A constant as well as the top present is actually 40A for final 10 second

Features:

1. Based on BL-Heli firmware, additional enhanced to the ideal steer efficiency.

2. Low-voltage security, over-heat security, as well as strangle indicator reduction security.

3. Separate energy source for MCU as well as BEC, improving the ESC's ability to get rid of magnetic disturbance.

5. Throttle variety could be readied to work along with various recipients.

6. Equipped along with integrated direct BEC or even change BEC.

7. Max rate: 210,000 rpm for 2-pole, 70,000 rpm for 6-pole, 35,000 rpm for 12-pole.

3.3.6 4mm RC Gold Bullet Connector

4.0mm banana connect port connect, for esc to bldc electric motor link. The style of the brand-brand new man head form, enhance the get in touch with surface area location compared to regular 4.0mm banana connect can easily more present. Basic materials safe lead-free, in conformity along with the ROHS ecological requirements [18]. Connect gold layering 24K, density of 0.05 mu m, connect countless layering will certainly not diminish. The density of the covering participates in the function of safeguarding the connect to avoid oxidation as well as extend the life span. Great electric conductivity, steady, continuous temperature level, constant discharge.

Figure 3:10 4mm RC Gold Bullet Connector

Details:

- ✓ 60021 (a pair of male + female)
- ✓ 60022 (male)
- ✓ 60023 (female)
- ✓ Metal material: Copper
- ✓ Application: used for motor
- ✓ Product weight: 2.86g/se
- ✓ new tail wire slot, convenient welding line

3.3.7 Propeller:

Nylon Propeller 8×4.5 8045 CW CCW

Figure 3:11Nylon Propeller 8×4.5 8045

- ➢ Material: carbon dioxide nylon material
- ➢ Size: 8 x 4.5"
- ➢ Color: dark
- ➢ Weight: 14g every set
- ➢ Diameter of facility birthed: 5.0mm
- ➢ Thickness of facility: 9.7mm
- ➢ Hole dimension: 5mm along with 3mm, 3.17mm as well as 4mm adapters. Could be reamed to 6mm or even 1/4″ if required.
- ➢ Recommended wheelbase: 550mm - 700mm
- ➢ Recommended electric motor: 800KV - 1400KV

3.3.8 Fly-sky FS-i6X 6-10(Default 6) CH 2.4GHz AFHDS RC Transmitter w/ FS-iA6B Receiver

The transmitter and receiver are used to communicate with the quadcopter. They must match, and your quadcopter should only respond to your controller. It's mainly used for flight control. But you can also use it for controlling an attached camera[13].

The FS-i6X transmitter and FS-X6B receiver constitute a 2.4GHz AFHDS 2A digital proportional computerized RC system. This system offers superior protection against interference while maintaining lower power consumption and high reliable receiver sensitivity. It is specially developed for all radio control models.

[14]The transmitter as well as recipient are actually utilized to interact along with the quadcopter. They should suit, as well as your quadcopter ought to just react for your operator. It is primarily utilized for trip command. However you can easily likewise utilize it for managing a connected video cam.

The FS-i6X transmitter as well as FS-X6B recipient make up a 2.4GHz AFHDS 2A electronic symmetrical electronic RC body. This body provides exceptional security versus disturbance while preserving reduced energy usage as well as higher dependable recipient

Figure 3:12 FS-i6 Transmitter

level of sensitivity. It is actually specifically designed for all of broadcast command designs.

Embrace AFHDS 2A (Automated Regularity Jumping Electronic Body 2nd) innovation. Providing exceptional security versus disturbance while preserving reduced energy usage as well as higher dependable recipient level of sensitivity. Getting information coming from temperature level, elevation as well as lots of various other kinds of sensing units, servo calibration as well as i-BUS. I-BUS Support[18].

FS-i6X Transmitter Specifications:

- ❖ Channels: 6-10 (default 6)
- ❖ Model type: Fixed-Wing/Glider/Helicopter/Quadcopter
- ❖ RF : 2.408-2.475GHz
- ❖ RF power: <20dBm
- ❖ RF Channel: 135
- ❖ Bandwidth: 500KHz
- ❖ 2.4GHz system: AFHDS 2A / AFHDS
- ❖ Modulation type: GFSK
- ❖ Stick resolution: 4096
- ❖ Low voltage warning: <4.2V
- ❖ DSC Port: PS/2 Port
- ❖ Chargeable: No
- ❖ Antenna Length: 26mm (Dual Antenna)
- ❖ Weight: About 400g
- ❖ Power: 4 * AA battery (not included)
- ❖ Display: STN translative display, LCD 128*64 lattice, VA 73*39mm, LCD with white backlight
- ❖ Size: 190 * 174 * 89mm
- ❖ On-Line Update: Yes
- ❖ Color: Black

FS-X6B Receiver Specifications:

- ✓ Channels: 6(PWM), 8(PPM), 18(i-BUS)
- ✓ 2.4GHz protocol: AFHDS 2A

- ✓ Model type: Multi-rotor
- ✓ RF : 2.408-2.475GHz
- ✓ Band width: 500KHz
- ✓ Number of bands: 135
- ✓ RF power: No more than 20dBm
- ✓ RX Sensitivity: -95dBm
- ✓ Modulation type: GFSK
- ✓ Stick resolution: 1024
- ✓ Low voltage alarm: Yes

3.3.9 Imax_B3 charger

This simple charger will do the job: plug in the compatibility connector, charging only 2s or 3s batteries without the need for further adjustment. Dual color LEDs indicate the status of each cell: red - in charge progress, green - the cell is fully charged.

Important! Never leave the charger and battery without monitoring while charging. A faulty charger or damaged battery can cause a fire, causing damage to property or human health or life[15].

Figure 3:13Imax_b3 charger

Main benefits:

1. Charging current: 850 mA

2. Input voltage: 110 - 240V

3. Cells on the battery: 2 or 3

4. Charging Power: 10W

Package included

1. The invader

2. Power cord

3.4 Additional sensors and its characteristic

3.4.1 Arduino Mega 2560:

Arduino is actually a device for creating computer systems that can easily be feeling as well as command more of the bodily world compared to your desktop. It is an open-source bodily calculating system based upon an easy microcontroller panel as well as an advanced atmosphere for composing software applications for the panel. Arduino could be utilized to create interactive items, taking inputs coming from a selection of changes or even sensing units, as well as managing a selection of illuminations, electric motors, as well as various other bodily outcomes[16].

Arduino Jobs could be stand-alone, or even they can easily interact along with software applications operating on your computer system. The panels could be put together manually or even bought preassembled; the open-source

IDE could be downloaded and install free of charge. The Arduino programs foreign language is actually an application of Electrical circuitry, a comparable bodily calculating system, which is actually based upon the Handling interactives media programs

atmosphere. Certainly, there certainly are actually lots of various other microcontrollers as well as microcontroller systems offered for bodily calculating.

Arduino Pin Representation:

The affix setup of this particular Arduino huge 2560 panel is actually revealed listed below. Every affix of this particular panel happens through a specific work that's allied using it. All of the analog pins of this particular panel could be utilized as electronic I/O pins. By utilizing this panel, Arduino's huge forecast could be developed. These panels deal with versatile function moment area is actually the more & handling energy that allows dealing with various kinds of sensing units without hold-up. When our team compare to various other kinds of Arduino panels, these panels are actually GND Affix

The Arduino Huge panel consists of 5-GND pins where among these pins could be utilized whenever the job needs it. Literally exceptional

Affix 3.3V & 5V:

These pins are actually utilized for offering o/p-controlled voltage of roughly 5V. This RPS (controlled energy source) offers the energy to the microcontroller in addition to various other elements which are actually utilized over the Arduino huge panel. It could be achieved coming from Vin-pin of the panel or even another controlled voltage supply-5V or else USB cable television, [11]whereas another voltage control could be provided through 3.3V0-pin. Limit energy could be attracted through this is actually 50mA

Reset (RST) Affix

The RST affix of this particular panel could be utilized for rearranging the panel. The panel could be rearranged by establishing this affix to reduced.
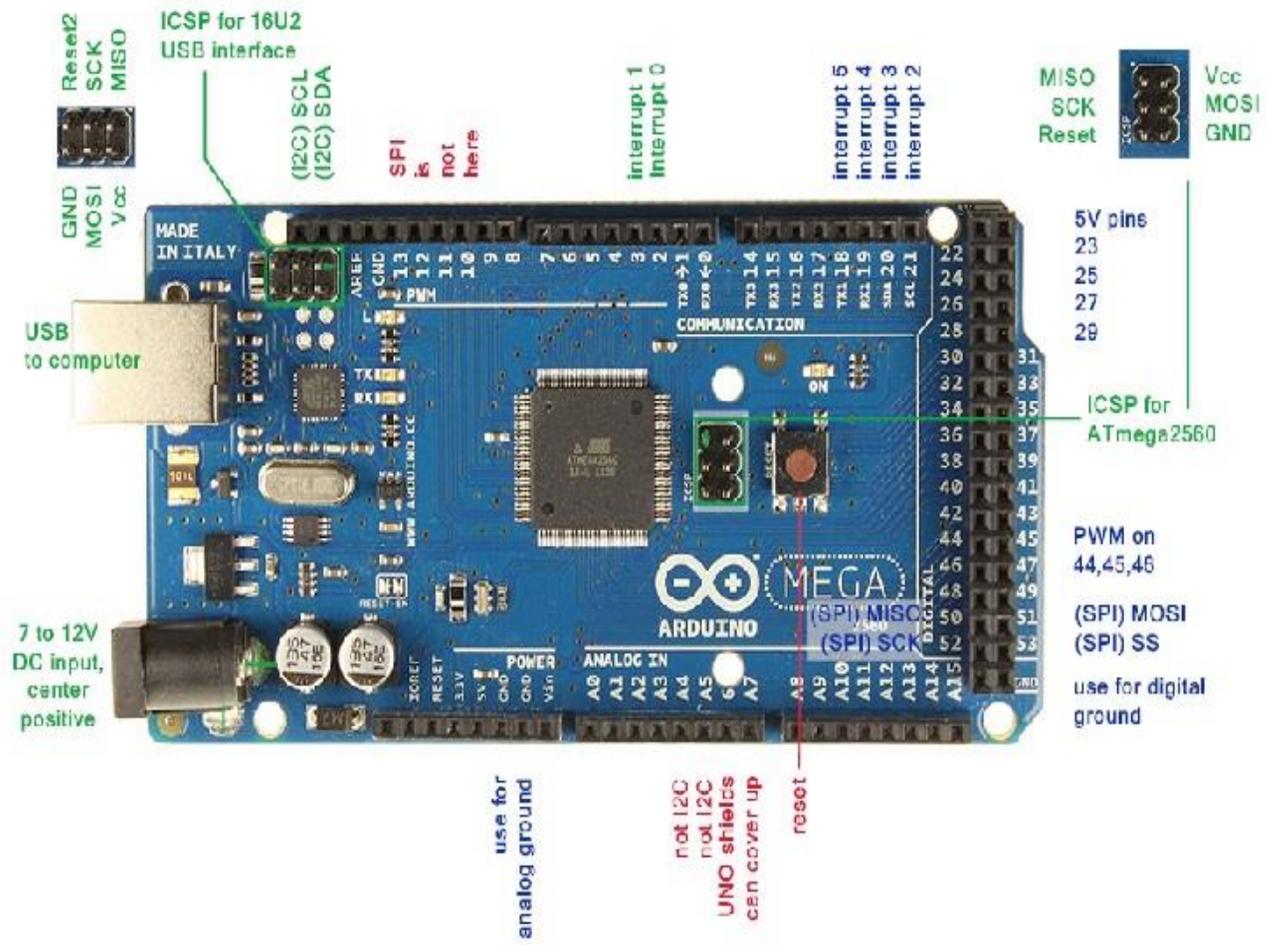
Figure 3:14Arduino mega 2560 board

Vin Affix

The variety of provided input voltage to the panel varies coming from 7volts to 20volts. The voltage offered due to the energy port could be accessed with this affix. Nevertheless, the outcome voltage with this affix to the panel will certainly be actually immediately collected as much as 5V.

Serial Interaction

The serial pins of this particular panel like TXD as well as RDX are actually utilized to transfer & get the serial information. Tx suggests the gear box of info whereas the RX suggests get information. The serial pins of this particular panel have actually 4 mixes. For serial 0, it consists of Tx (1) as well as Rx (0), for serial 1, it consists of Tx(18) & Rx(19),

for serial 2 it consists of Tx(16) & Rx(17), as well as lastly for serial 3, it consists of Tx(14) & Rx(15

Outside Interrupts

The outside interrupts could be created by utilizing 6-pins like disrupt 0(0), disrupt 1(3), disrupt 2(21), disrupt 3(20), disrupt 4(19), disrupt 5(18). These pins create interruptions through a variety of methods i.e. Offering LOW worth, increasing or even becoming side, or even altering the worth to the disrupt pins.

LED

This Arduino panel consists of a LED which is actually allied to pin-13 which is actually called electronic affix thirteen. This LED could be run based upon the low and high worth's of the affix. This will certainly provide you to change the abilities of the program in real-time.

Analog Pins

Certainly there certainly are actually 16-analog pins consisted of on the panel which is actually indicated as A0-A15. It is actually extremely important to understand that the analog pins on this panel could be used like electronic I/O pins. Every analog affix comes along with the 10-bit settlement which can easily evaluate coming from GND to 5 volts. However,[14] the greater worth could be changed utilizing the AREF affix in addition to the work of analog Recommendation ().

I2C

The I2C interaction could be sustained through 2 pins specifically twenty & 21 where 20-pin represents Serial Information Collection (SDA) which is actually utilized for keeping the information & 21-pin represents Serial Time clock Collection (SCL) mainly used for providing information synchronization amongst the gadgets

SPI Interaction

The phrase SPI is actually a sequential peripheral user interface that's utilized to transfer the information amongst the operator & various other elements. 4 pins like MISO (50), MOSI (51), SCK (52), as well as SS (53) are actually used for the interaction of SPI.

3.4.1.1 Five Steps to Program an Arduino.

Courses composed in Arduino are actually referred to as illustrations. A fundamental sketch includes 3 components

1. Statement of Variables

2. Initialization: It is actually composed in the configuration () work.

3. Command code: It is actually composed in the loophole () work.

The sketch is actually conserved along with. Into expansion. Any type of procedures like confirming, opening up a

sketch, conserving a sketch could be performed utilizing the switches on the toolbar or even utilizing the device

- ➢ The sketch ought to be actually kept in the sketchbook directory site.
- ➢ Chose the appropriate panel coming from the devices food selection as well as the serial slot varieties.
- ➢ Click on the submit switch or even selected submit coming from the devices food selection. Therefore, the code is actually
- ➢ uploaded due to the boot loader into the microcontroller

Arduino Mega Specifications:

The specifications of Arduino Mega include the following.

- ✓ The ATmega2560 is actually a Microcontroller
- ✓ The running voltage of this particular microcontroller is actually 5volts
- ✓ The suggested Input Voltage will certainly variety coming from 7volts to 12volts
- ✓ The input voltage will certainly variety coming from 6volts to 20volts
- ✓ The electronic input/outcome pins are actually 54 where 15 of these pins will certainly source PWM o/p.
- ✓ Analog Input Pins are actually 16
- ✓ DC Present for every input/outcome affix is actually 40 mA
- ✓ DC Present utilized for 3.3V Affix is actually fifty mA
- ✓ Flash Moment like 256 KB where 8 KB of blink moment is actually utilized along with the assist of boot loader
- ✓ The fixed random-access moment (SRAM) is actually 8 KB
- ✓ The electrically erasable programmable read-only moment (EEPROM) is actually 4 KB
- ✓ The time clock (CLK) rate is actually 16 MHz
- ✓ The USB multitude potato chip utilized within this particular is actually MAX3421E
- ✓ The size of this particular panel is actually 101.52 mm
- ✓ The size of this particular panel is actually 53.3 mm
- ✓ The value of this particular panel is actually 36 g

3.4.2 Five Way flame:

Utilize this component to spot fire in a big variety (>120 level). Ideal if you desire your robotic to spot if there's any type of fire about. It spots fire along with the 5 fire sensing units which are actually organized in 120 level discovery variety, along with each sensing unit offering a 30-level discovery variety. This component outcome an analog indicator, which can easily offer an extremely accurate continuing reading each sensing unit, and an electronic indicator which is actually extremely user-friendly, you can easily change the

electronic outcome level of sensitivity due to the on-board potentiometer. The 5 LED signs are actually useful in debugging as well as screening

Advantage:

Five network fire sensing unit style, a wide variety of discovery (the discovery variety of the regular solitary fire sensing unit is actually most likely around 30°, as the range enhances, the variety is actually slowly decreased, the discovery variety of the item is actually higher than 120°)

- Able to outcome an electronic indicator (higher as well as low), user-friendly
- Able to outcome an analog indicator (voltage signal), the dimension indicator could be more precise, the events for higher accuracy
- All 5 outcomes condition sign, therefore whether debug or even carry fantastic benefit in the useful request of
- Digital outcome discovery is range flexible. The analog outcome level of sensitivity flexible, more versatile style
- Using a 1% resistor style, the indicator outcome is actually more precise, appropriate for the requirements of high-precision dimension events
- Onboard 3 M3 installing openings for simple setup
- 3.3V-9V energy source, as well as works along with the majority of the SCM body

Specification:

Voltage: 3.3V – 9V

Analogue & Digital outputs

Pin Definition:

GND: Ground

VCC: Input voltage (3 : 9v)

A1, A2, A3, A4, A5: Analog output

D1, D2, D3, D4, D5: Digital output
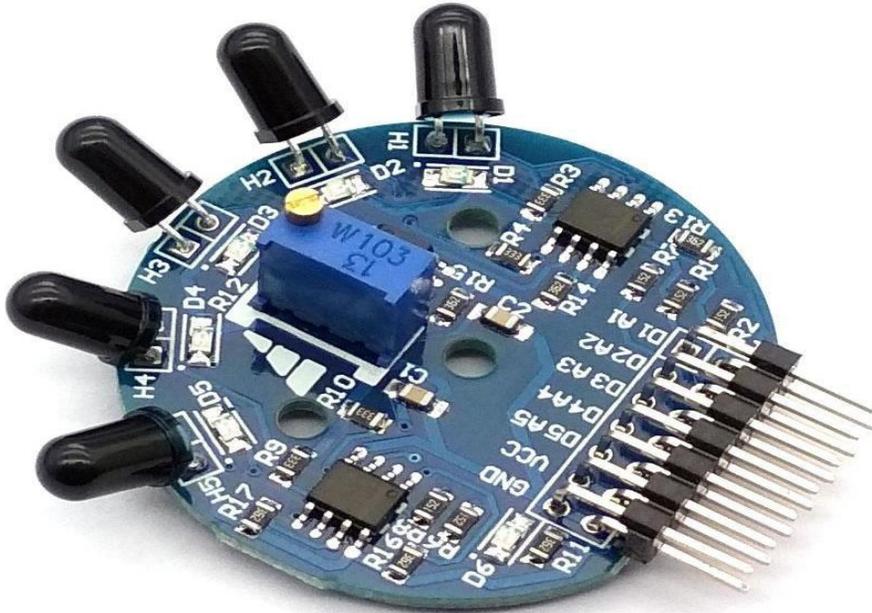
Figure 3:15Five-way flame

3.4.3 **MQ135 Gas Sensor**:

On the planet of innovation, certainly there certainly are actually lots of sensing units being actually utilized to screen as well as command house requests, robotics, commercial automation, and so forth. Certainly there certainly are actually various sensing units for various functions. As the like individual has actually the various noticing ability for a various function. Within this particular job[16], our team is actually concentrating on the MQ-135 fuel sensing unit to screen the atmosphere. MQ-135 fuel sensing unit primarily utilized to determine the intensity of NH3, NOx, Booze, Benzene, Smoke, CO2.

Figure 3:16MQ-135 Gas Sensor

MQ-135 Gas Sensor Features:

1. Fast reaction as well as Higher level of sensitivity

2. Wide spotting range

3. Operating Voltage is actually +5V

4. Detect/Determine the intensity of NH3, NOx, booze, Benzene, smoke, CO2, and so on.

5. Analog outcome voltage: 0V to 5V

6. Digital outcome voltage: 0V or even 5V (TTL Logic)

7. Preheat period twenty secs

8. Can be actually utilized as an electronic or even analog sensing unit

9. The Level of sensitivity of the Electronic affix could be different utilizing the potentiometer

MQ135 pin out:

There are 4 pins in the MQ-135 gas sensor. The sensor can output both digital and analog signals. The operating voltage of the MQ-135 gas sensor is 5 volts. The pins are in Description:

| Pin No.	Pin Name
1	Vcc(+5V)
2	Ground
3	Digital Out
4	Analog out
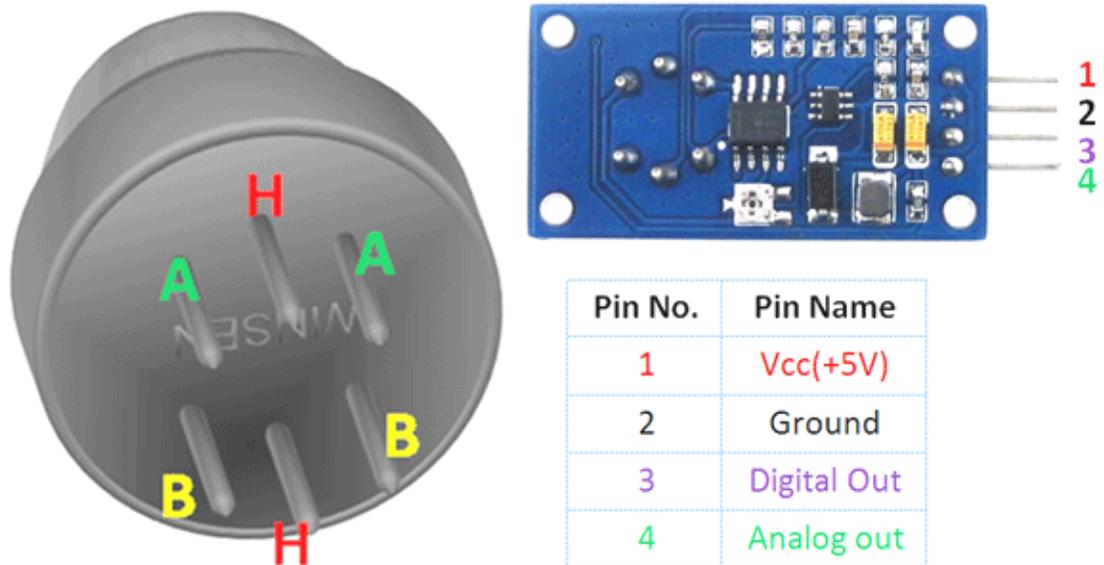
Figure 3:17 MQ135 gas sensor pin

1. The VDD energy source 5V DC

2. GND, utilized to link the component to body ground

3. DIGITAL OUT, You can easily likewise utilize this sensing unit to obtain electronic outcome coming from this pin, through establishing a limit worth utilizing the potentiometer

4. ANALOG OUT, This affix outcomes 0-5V analog voltage based upon the strength of the fuel

3.4.4 Optical Dust Sensor - GP2Y1010AU0F:

Sharp's GP2Y1010AU0F is actually an optical sky-high quality sensing unit, or even might likewise refer to as optical dirt sensing unit, is actually developed to feeling dirt bits. An infrared-producing diode, as well as a phototransistor, are actually diagonally organized into this gadget, to enable it to spot the shown illumination of dirt in the sky[19]. It is actually particularly efficient in spotting extremely great bits like cigarette smoke, as well as is actually typically utilized in sky cleanser bodies.
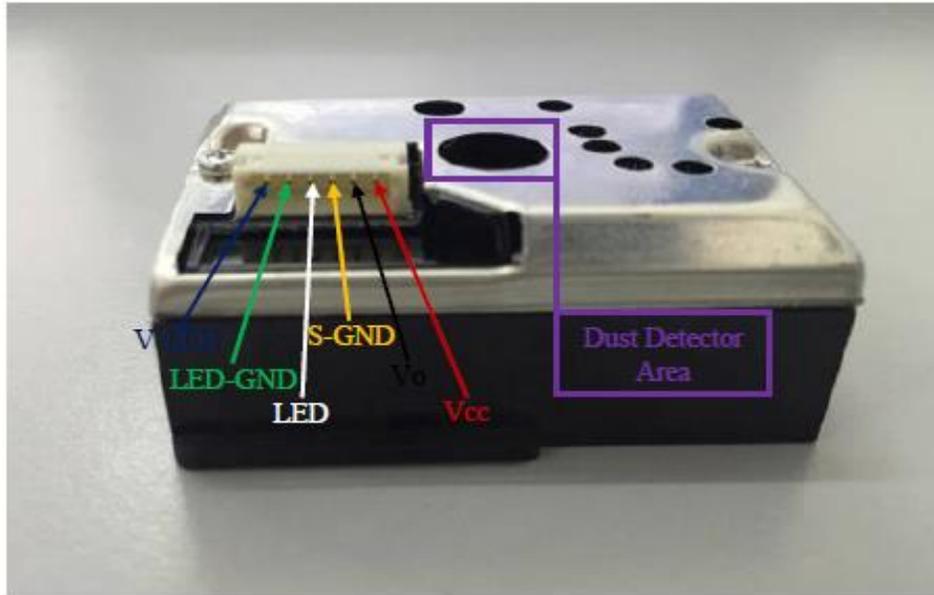
Figure 3:18 Optical Dust Sensor - GP2Y1010AU0F

Specifications:

1. Low Present Usage (MAX: 20mA)

2. Typical Running Voltage: 4.5V to 5.5V (MAX: 7V)

3. The existence of dirt could be spotted due to the photometry of just one rhythm

4. Enable to recognize smoke coming from home dirt

5. Dimensions: 1.81 x 1.18 x 0.69" (46.0 x 30.0 x 17.6mm)

Pin	Function
V-LED	Connect to 5.0V with resistor of 150Ω in between.
LED-GND	Connect to GND.
LED	Connect to any digital pin of Arduino Board.
S-GND	Connect to GND.
Vo	Connect to any analog pin of Arduino Board.
Vcc	Connect to 5.0V.

3.4.5 GSM Module 900A:

With the blooming improvement of IoT (Internet of Things), greater and greater human beings are dedicated to pursue their very own IoT dreams. However standard IoT applied sciences are in most cases evolved on the groundwork of Wi-Fi features, which leads to a barrier of improvement associated to Delimitations that IoT initiatives can't be applied in to outdoor. In mild of the reputation of bike-shared system, GSM Data Communication has been reconsidered as the excellent preference for outdoor IoT solution. The Gravity: A6 GSM & GPRS Module is a new GSM & GPRS communication module introduced with the aid of DF-Robot. Differ from standard IoT growing modules[9].

A6 GSM & GPRS Module allows its features rely on GSM rather of Wi-Fi. It can make a name and ship textual content message with a small and transportable GSM SIM card. This technological gain makes bigger the area of IoT software area, specifically for the out of doors scene. In addition, you can DIY a smartphone with a 3.5mm headphone port; it additionally works properly in different situations with onboard 1500uF electrolytic capacitor and except any exterior energy supplies even in the immediately excessive modern. The module Uart port degree is solely 2.8V, which means it is like minded with Adriano, Raspberry-Pi and different controllers

Feature:

   i.   Operating temperature -30 ℃ to + 80 ℃;

  ii.   1KG peak suction

 iii.   Low standby current

 iv.   Operating Voltage 3.3V-4.2V;

  v.   Power voltage> 3.4V;

 vi.   Standby average current 3ma less;

 vii.   Support the GSM / GPRS four bands, including 850,900,1800,1900MHZ;

viii.   Support China Mobile and China Unicom's 2G GSM network worldwide;

 ix.   GPRS Class 10;

  x.   Sensitivity <-105;

Specification

Figure 3:19 GSM 900A

i.   Quad-band: 850/900/1800/1900 MHz

ii.   GPRS multi-slot: 12, 1 to 12 may be configured

iii.   GPRS mobile station: Class B

iv.   Compatible with GSM Phase 2/2 +: Class 4 (2W @ 850/900 MHz) Class 1 (1W @ 1800 / 1900MHz)

v.   Supply voltage: 3.3 ~ 4.2V 4.0V typ.

vi.   Current consumption: 1.3mA @ DRX = 5; 1.2mA @ DRX = 9

vii.   AT command control: Standard GSM07.07,07.05 AT commands and extended

viii.   commands Ai-Thinker

ix.   SIM Application Toolkit

x.   GPRS Class 10: Up 85.6 kbps (upstream) & 42.8Kbps (downlink)

xi.   PBCCH support

xii.   Coding scheme: CS 1, 2, 3, 4

xiii.   Support CSD: Up 14.4 kbps Support USSD

xiv.   Stack: PPP / TCP / UDP / HTTP / FTP / SMTP / MUX

CHAPTER 4

EXPERIMENTAL RESULTS AND DISCUSSION

4.1 Block Diagram of the Quadcopter:

Fly Sky FS-i6 2.4G 6CH AFHDS RC Transmitter along with FS i6 Recipient is actually utilized to offer required indicators to the RC Recipient installed in addition to the framework to steer the 4 electric motors in suitable instructions (Electric motor 1,3 in clockwise as well as Electric motor 2,4 in respond to clockwise instructions). However, the security of the quadcopter throughout the trip is actually accomplished by utilizing an MPU 6050 3 axis Gyro that currently in the kk2.1.5 trip operator. As well as in our made a proposal design trip operator rather than a conventional one. The kk2.1.5 trip manages the rate of the electric motors to acquire security as well as a soft trip. Right below kk2.1.5 trip operator handles the indicators going through the electric motors along with the assist of 4 30A EMAX ESC.
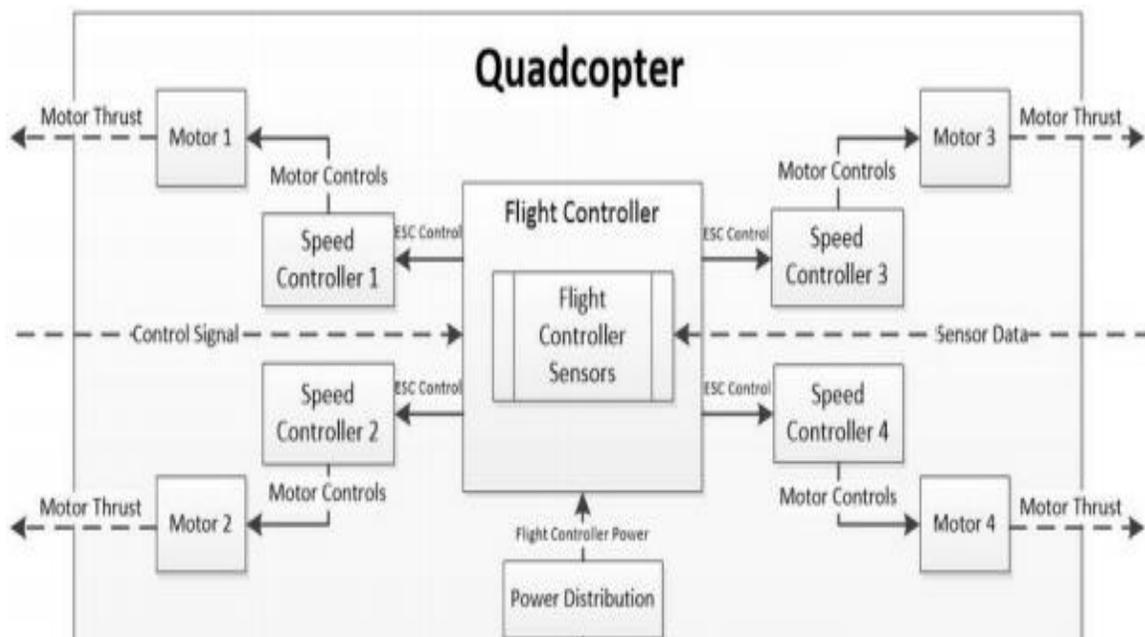

Figure 4:1 Block diagram quadcopter process

4.2 Connecting the Components of quadcopter:

4.2.1 Electronic Speed Control (ESC) connection:

Now comes our connecting components, at first we built our quadr-copter, we take frame s500 that's very good frame and given PDB board include that.

Firstly, we work on Power distribution Board (PDB) for quadcopter .so we are soldering 4 esc into the PDB board. Battery connecting two wire Red and Black are connected positive and negative to connect ESC to battery and this wire must be need silicon cable because this cable transfer high-rate power supply for motor. Then ESC has one end has three wires two are going to PDB board and last one is going flight controller
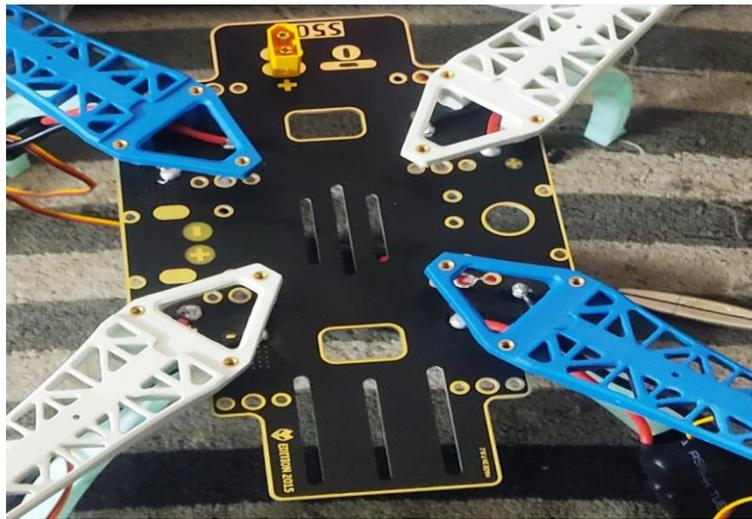

Figure 4:2 ESC soldering in Frame

4.2.2 Brushless Motor connection with ESC:

Then we are doing blushless motor work. The Brushless DC motor is the high-speed motor and it designed to run form direct current power supply. Bldc motor is a universal motor it can rotation clock wise and anti-clock wise. There are many more motor companies available in the world EMAX is the best motor construction, low cost, better performance and reliability for Aerial vehicle and maximum aerial vehicle use in this motor.
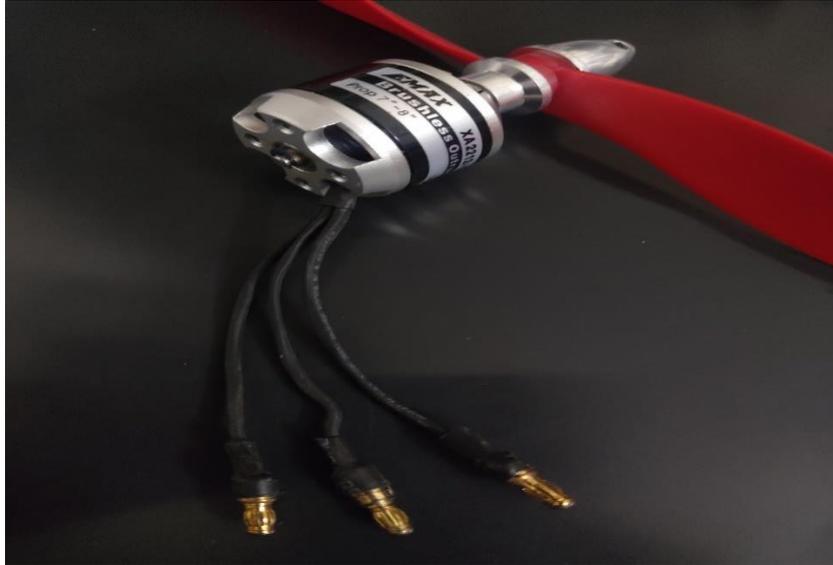
Figure 4:3after bullet connection adding in BLDC

In the brushless motor has three wire and it connected with ESC another end, this ESC has 3 wired for connecting bldc motor for better speed controlling.


Figure 4:4 after connection bullet connector in ESC

Now we are connecting motor positive to ESC positive, motor negative to ESC negative and motor signal to ESC signal.

Adding battery:

Then we set the battery in the PDB board for powering the motor and ESC, we used 11.1v 2200mhA 3 cell battery for fly the quadcopter. Battery connecting two wire Red and Black are connected positive and negative to connect ESC to battery and this wire must be need silicon cable because this cable transfer high-rate power supply for motor.

4.2.3 Kk2.1.5 flight controller setup:

Now we are setting top of the bottom kk2.1.5 flight controller. that is most important part of the drone for stability. Four ESC signal pin going to kk board M1, M2, M3,M4 .
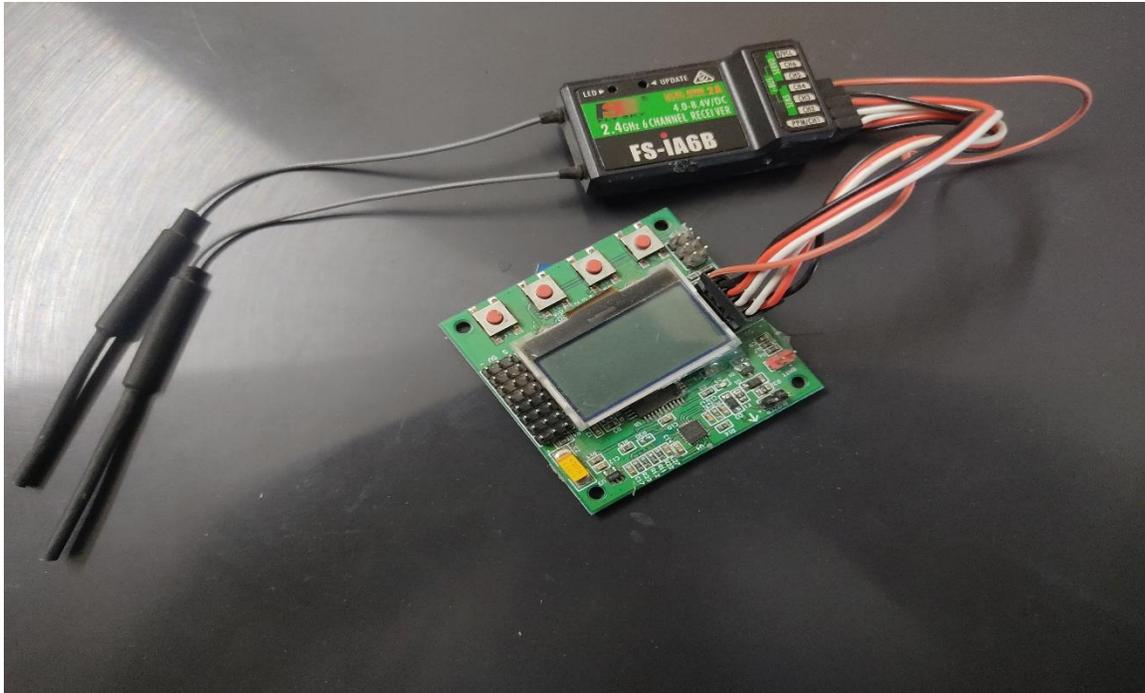
Figure 4:5Receiver setting in kk Board

4.2.4 Gas detection:

As with all detectors the surroundings that they will be working in determines the placement of gasoline detectors.

We are using MQ135 gas sensor to detection gas in nature or air. And it gives us SMS when any dangerous gas are detection in air or area. The MQ-135 sensor has low conductivity when the air is clean. When the sensor detects gases such as ammonia, alcohol, benzene, smoke and carbon dioxide, the conductivity of the sensors is greater alongside with the amplify in fuel concentration. An electro circuit is used that converts the trade in conductivity to correspond to the output sign of the fuel concentration

There are 4 pins in the MQ-135 gas sensor. The sensor can output both digital and analog signals. The operating voltage of the MQ-135 gas sensor is 5 volts.
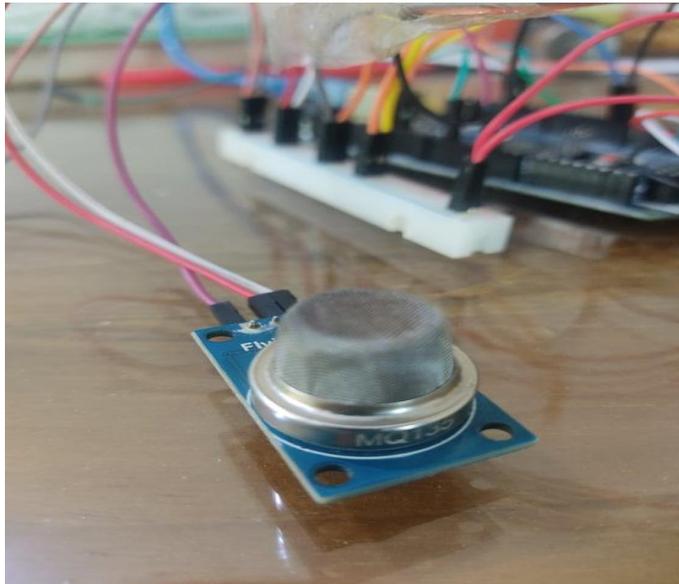
Figure 4:6 MQ135 gas sensor connection

4.2.5 Flame Detection:

It detects fire with the 5 flame sensors which are arranged in 120-degree detection range. Flame Ground goes to Adriano Ground and VCC needs voltage 9v highest and Analog output Pin A1, A2, A3, A4, A5 Digital output pin D1, D2, D3, D4, D5:
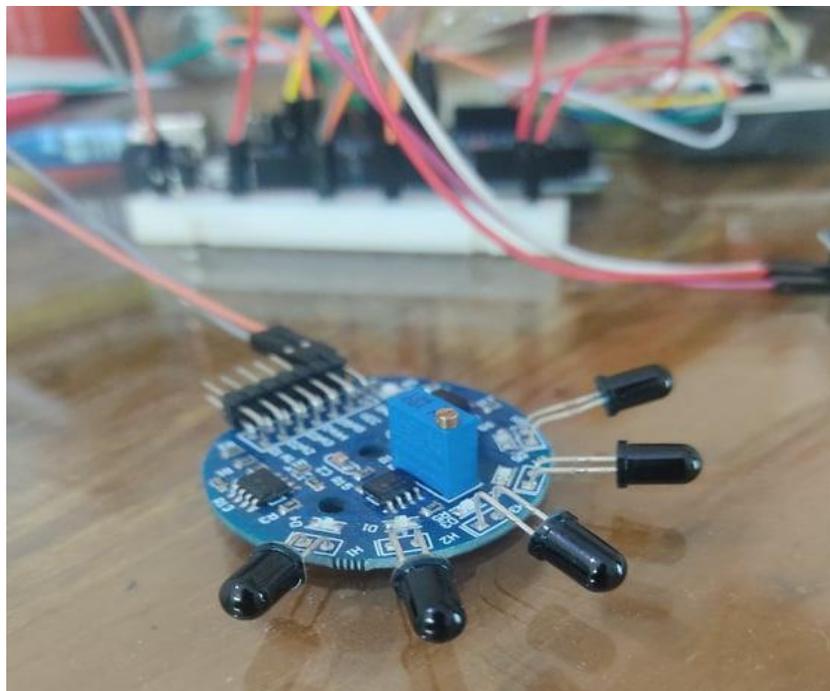

Figure 4:7 Flame module connections with Arduino

4.2.6 Optical dust sensor:

Connect the 3.3V/5V pin of the Arduino board to the VCC pin of the dust sensor module.

- V-LED ----- Arduino 5V with 150Ω resistor in between
- LED-GND ----- Arduino GND
- LED ------ Arduino Digital Pin 12
- S-GND ----- Arduino GND
- Vo ------ Arduino Analog Pin 5
- Vcc ----- Arduino 5V
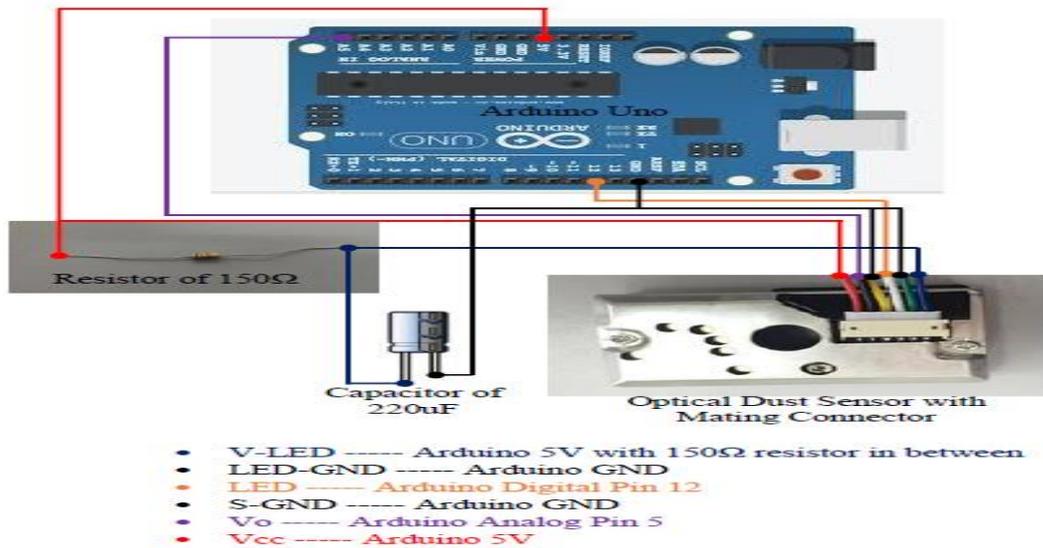
Figure 4:8 Dust sensor connection diagram

Connect the V-LED of the sensor to the 100Ω resistor. Connect the sensor's LED-GND and S-GND pins to the ground pin of Adriano. The LED pin of the sensor should be connected with Arduino digital pin12, which is known as the output pin of the dust

Figure 4:9 Connection with Arduino Sensor module.

The V0 pin — which is an Analog pin — must be connected with the Adriano analog pin to A0. The Adriano code will output the dust concentration level of the sensor in the OLED 128X32

## 4.2.7   Whole circuit Connection:
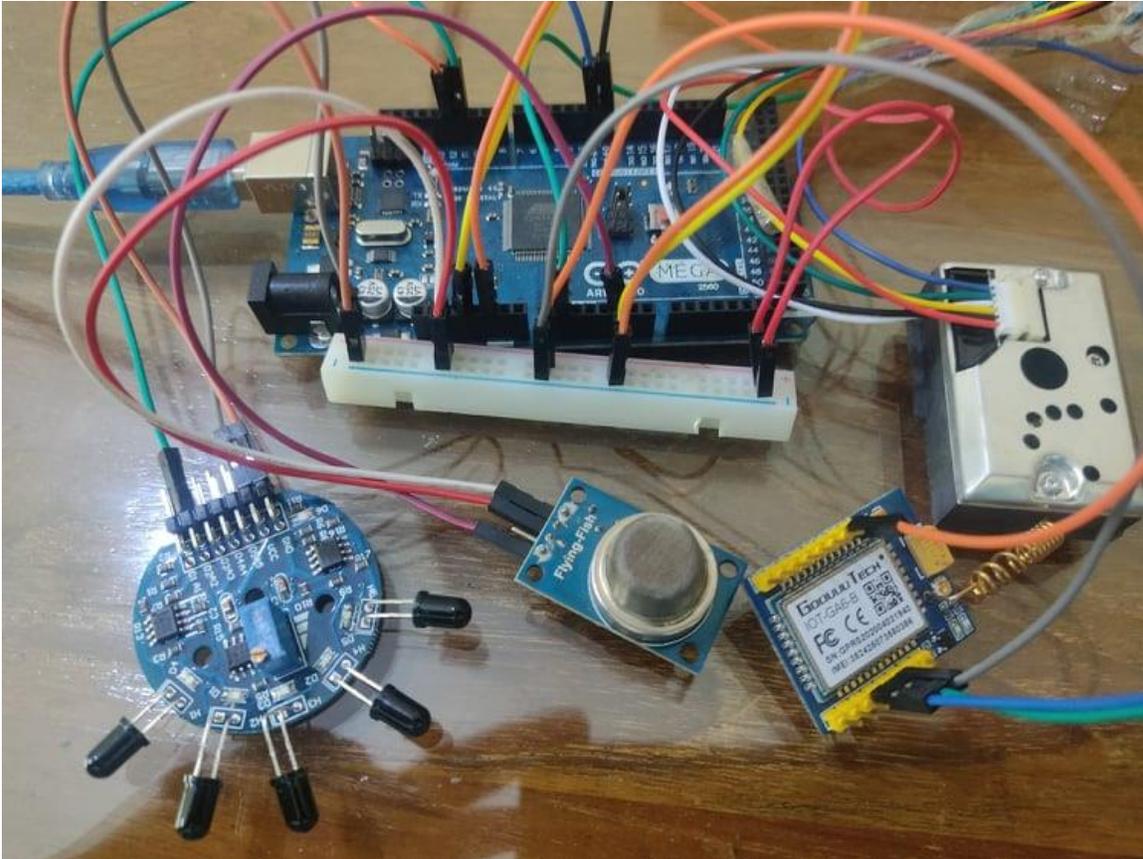
Figure 4:10 Whole circuit connection

## 4.2.8 After powering the circuit:
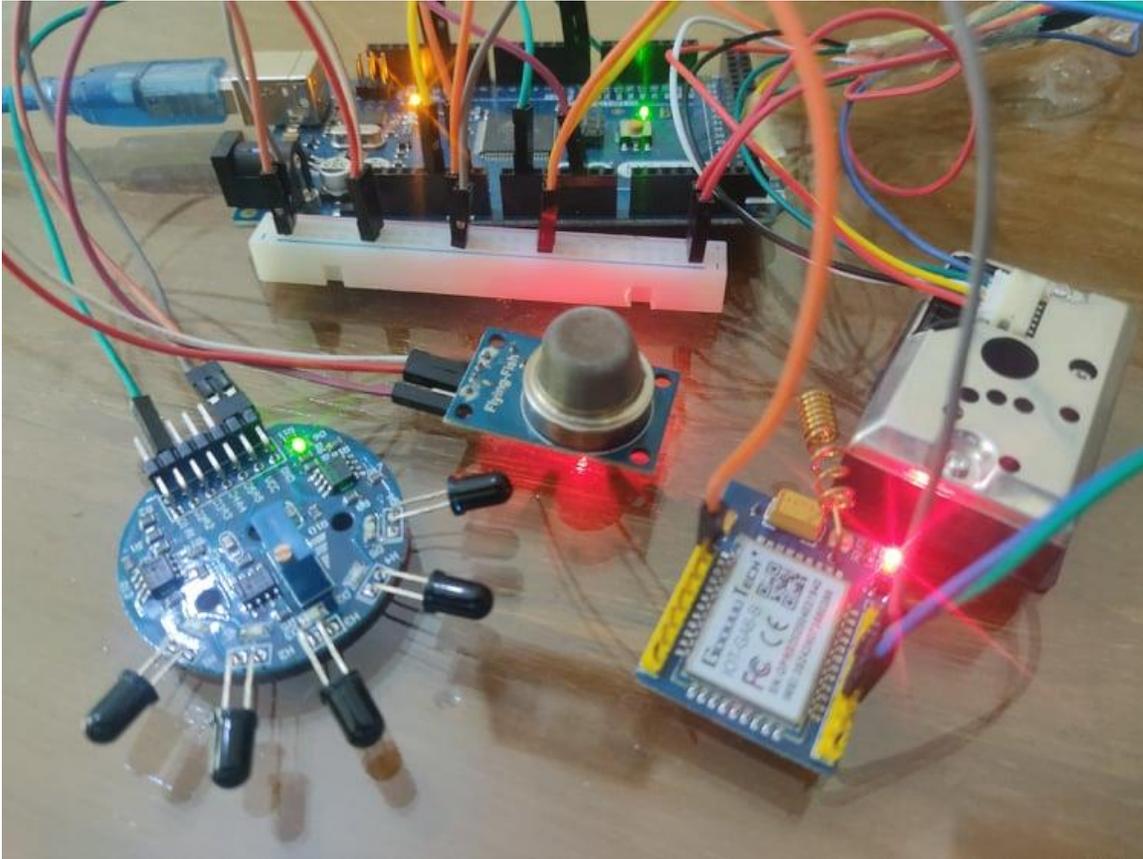
Figure 4:11 after powering the circuit

4.3   Result:

After completing the connection and setting its ready to fly in the sky and also able to detect fire or flame, gas and air quality measuring.
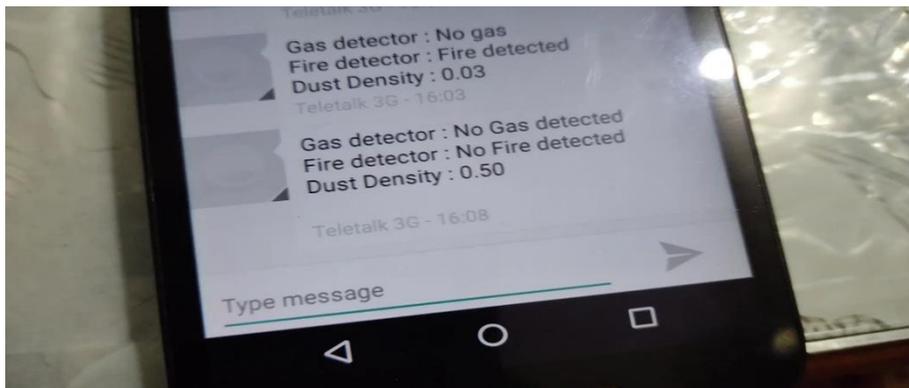
Figure 4:12 f lying result and detection result

CHAPTER 5

CONCLUTIONS AND SUGGESTION FOR FUTURE WORK

5.1 Summary of the study:

In this project the focus was to collect the data from the environment about detection gas and other element like humidity temperature, flame detection, air quality of the area. And this project we are collecting data with the help of the aerial vehicle and the ground station and making detection gas flame and measuring air quality.

5.2 Conclusion

We have heard a lot about the challenges to create and this task when we will be making a challenge like this. It used to be a notable gaining knowledge of ride and, in the future, we will begin to create different Quad-Copter, which is why we select the idea. We constantly saved in idea to make the task person friendly. Our focal point was once to make the device suited to any person

5.3 Comparison

Type	Our Device	Other Device
Price	Lower to medium (20,000to 40,000)	Average to Higher (60,000 to 25,50,000)
Battery	Not Fixed and we can change different type of battery for long time fly.	Fixed battery and we not change and use other type of battery
Customize	We can Customize any part of device for example: Battery, Motor, Propeller, GPS, ESC, Frame and Flight Controller etc.	we cannot Customize any part of device

Broken	Suddenly any problem broken any part of device, smoothly we can change it.	We cannot change it and must be change hole device
Work Type	Work type not fixed for this device	Work type almost fixed.
Camera	We can set up any light weight camera	We can set up any light weight camera
Add Auxiliary device	We can easily add any type of light weight auxiliary device.	We cannot use any type of light weight auxiliary device.
Channel	We can increase and decrease transmitter and receiver channel.	Transmitter and receiver number of channels fixed.
Flight Mode	Flight Mode setup customize open. User can change this mode	Flight Mode setup customize open. User can change this mode
Performance	Performance Average to high.	High for specific work
Program and Configuration	We can change program and configuration.	Normally we cannot change program. If we change the program, the performance will down.
Life Time	Life Time	This device life time short.

5.4 Implication for Further Study

Our future work on quad-copters:

i. Using better flight controller
ii. Implementation camera
iii. Implementation GPS that also, the coordinates of the remote location can be obtained by attaching a GPS module in the quad-copter
iv. Implementation obstacle avoidance in quad-copters
v. In future we implementation fire extinguisher in quad-copter
vi. Making detection with IOT real time data reading
vii. Additionally, a camera could be fixed on the quad-copter for a live transmission of the location to where the quad-copter is flying. This feature can be used to survey a remote location from a safe location without actually going there

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