iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL
FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 Issue: IV Month of publication: April 2026

DOI: https://doi.org/10.22214/ijraset.2026.79394

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue IV Apr 2026- Available at www.ijraset.com

Fabrication of a Quadrotor Drone for Agriculture

N Tharun Teja, E Bhaskar, L Mani Deepika, J Bhanu Prasad, J Akash Reddy, Associate Prof. Dr.Sangamesh H B, Associate Prof. Mr. N Naresh
B.TECH I V– II SEM HOLY MARY INSTITUTE OF TECHNOLOGY & SCIENCE HITS, HYDHITS, HYD

Abstract: Drones,alsocalledUnmannedAerial Vehicles(UAV),have witnesseda remarkabledevelopmentinrecent decades.In agriculture, theyhavechanged farmingpracticesbyofferingfarmerssubstantialcostsavings,increasedoperational efficiency, andbetterprofitability. Thegoalofthisprojectistobuild,modify,andimproveanexistingagriculture quadcopter. Theprojectuseda Quadcoptermaterialthatincludedmotors, electronicspeedcontrollers,flightcontroller, batteries, a transmitter,a receiverand 3Dprintedframe.IndividualMotorwastestedwithArduinoboardandverifiedtoworkproperly.Agriculturalpesticidesandseedsdispersalis a verylabour-intensivetaskwithvariousproblems faced inmanualprocess.Humansprayingmay leadtoinadequateorspraying ofpesticidesincertainpartsoffield,also itis not safetohandlepesticideasexposurecancauseskinandbreathing problemsin human.So,flappermechanism was developedthat consistsofhorizontal blade rotateswhile thepesticide fromstorage tankflow throughthevacuum willbesprayedtotherequiredplaceinfield.Thisprojectaimistodesignanagriculturedronewithadditive manufacturingprocess. variouspartsofdronelikeframe,flappermechanismattachedwithstoragetankisdesigned intheAutodesk FUSION softwareandthenprintedwiththehelpof3Dprinter(material-PLA),thentheyare assembledwithaddition tovarious component slikeservomotorsetc.Overall,aimof the projectistodevelopa drone andspraythematerials with thehelp offlappermechanism.

I. INTRODUCTION

Ournation'sprimaryindustryisagriculture,yet whenitcomestoadoptingtechnologiesforgreaterfarmproductivity,westill lagfarbehindother nations.Theoverallamountinvestedintheagricultureindustryhasexpanded by72to80% over thelast 5 to6 years. Thisinvestment'sprimarygoalistoincreaseproductionbyatleast70%by theyear2050.Themostcrucial componentofsmartfarming and precisionagricultureis remotesensing.

ThefutureofremotesensinginPrecisionAgricultureandsmartframingisthoughttobeUAV-basedIOTtechnologies.

Becausepesticidesarethe primary meansofdestroyingpests,pesticidesare a biggerproblemforfarmersthanbugs.Asa result,drones areemployed tosprayurea andpesticidesto boostcropyield.

Todesigna dronefirstwehavetocalculateourpayload,thenwithrespecttheloadofpayloadmotor,electronicspeedcontroller,Propeller,Batteryhastobeselected. Batteryhastobe selectedbyknowingthe voltageandcurrentrequirementof thecomponents. Thenthethrust requirementhas to be calculatedandthedesign offramedecidedbydeterminingtherequired armnumber,armlength.

II. LITERATURE SURVEY

AccordingtotheWHO(World HealthOrganization),morethan1 millionpesticide casesarereportedannually.Morethan onelakhpeopledieeveryyear,mostlyinunderdevelopednations,asaresultofhumanhandlingandpesticidespraying.Inadditiontocancer,hormonedisruption,andissueswithreproductiveandfoetaldevelopment,pesticideexposurehasbeenlinkedtoasthma,allergies, andhypersensitivity.Theskinandeyes maybecomeinflamedbyotherinsecticides.

Prof B.Balajiet.al[1]haddescribeda designofan unmannedaerial vehicles(UAVs) thatcanbe usedtoestablisha control loopforagricultural applications,whereUAVs are inchargeofsprayingchemicalsoncropsandmonitoring bothagricultural fields andthe environment.However,UAVswillplaya significantpartinthe futureadvancementofprecisionagriculture

Karan Kumarshaw et.al[2]hasdescribeda designfora drone-mountedsprayingsystemfordisinfectionandagricultural applications. This methodofapplyingpesticides toagriculturalfieldscuts downon theamountoflabour,time,expense, and risk tothepeopledoing theactualspraying.

Kurkuteet.al[3]hadworkedona basic,cost-effectivequadcopterUAVanditssprayingsystem.Bothliquidandsolid contentsaresprayedusingtheuniversalsprayertechnology.Theyhavealsocomparedseveralcontrollersrequiredfor agriculturalapplicationsintheirresearch, andtheyhaveconcluded thatthequadcoptersystem withAtmega644PAisthemost appropriatedue toitseffectiveimplementation.

U.E Uche[4]had workedona basic,cost-effective quadcopterUAV anditsspraying system.Both liquidandsolidcontents have beensprayed usingthe universal sprayertechnology.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue IV Apr 2026- Available at www.ijraset.com

ThequadcoptersystemwithAtmega644PAisthemostappropriateduetoitseffectiveimplementation,accordingtotheirresearch,whichalsoexaminedvariouscontrollersrequiredfor agriculturaluses.

III. METHODOLOGY DESIGN OF AGRICULTURE DRONE

The3Dcomputer-aideddesign(CAD),computer-aidedengineering(CAE),andcomputer-aidedmanufacturing(CAM) softwareAutodesk Fusion360isextremelypotent.Withtheuseofa singletool, usersmaydesign,simulate,andproducegoods withthiscloud-basedsoftware

STEP– 1

VariouspartsofagriculturedronelikeVariouspartslikeArm,Baseplate,topcover, top plate,controllerup &downparts, storagetankand seeddispersal system tool etc, aredesigned in the part modellingsectionoftheCATIAsoftware. Various commandslikeExtrude,Assemble,line,circle,spline,trim,constrains,insertis used to draw2Dshapeswith required dimensionsandbyusingextrude commandtheyare extrudedaccordinglytotherequiredsize.

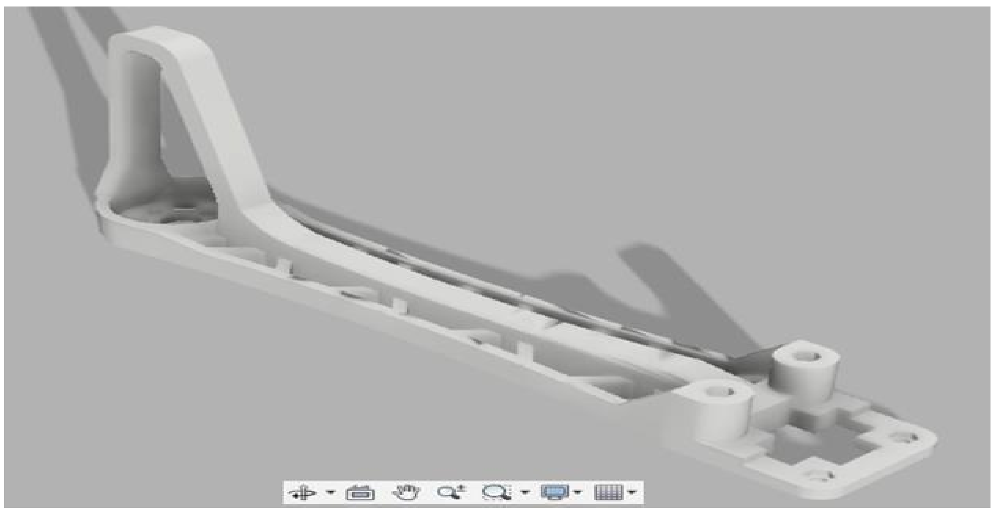


Figure3.1Arm

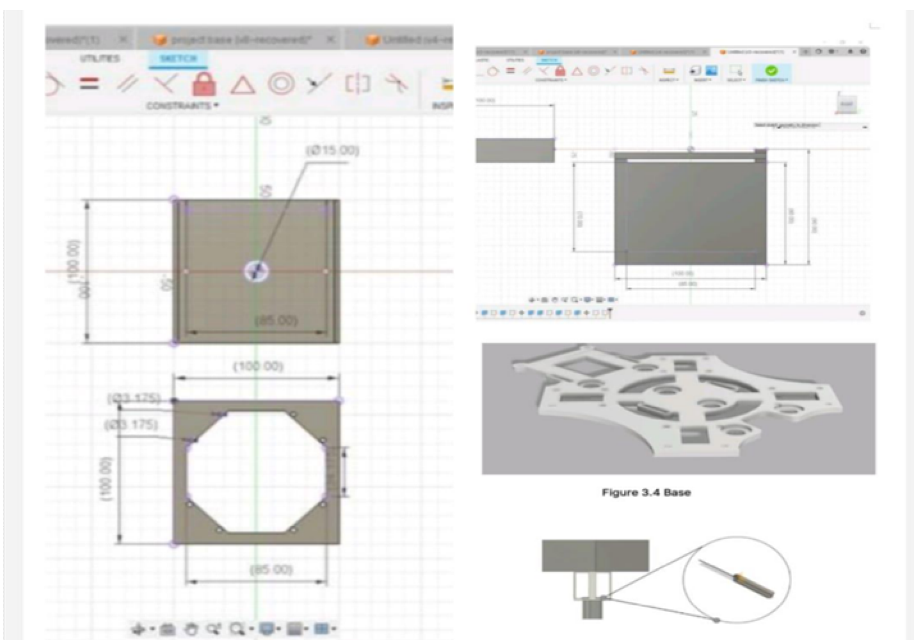


Figure3.2

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue IV Apr 2026- Available at www.ijraset.com

STEP– 2

Oncetheindividualpartsaredesignedinthesketchsection, thensomerequiredsub-assemblies aremadein theAssembly sectionof theFUSION 360software.Thesesub-assemblies makethefinalassemblymucheasier.

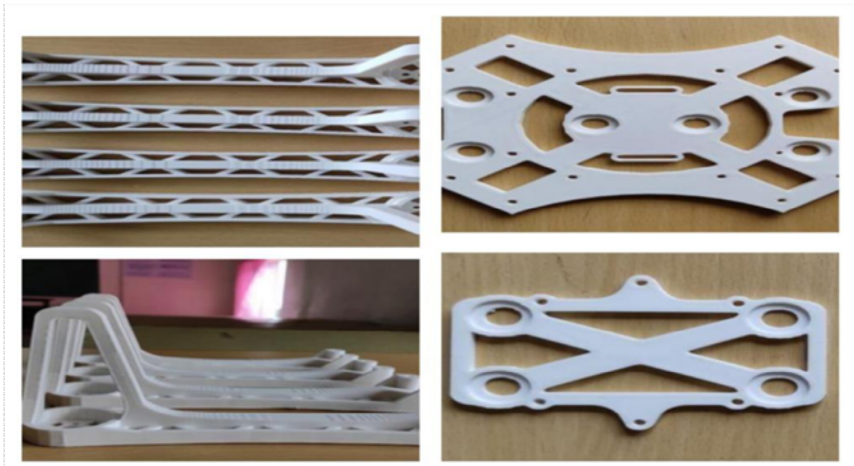


Figure3.3Flight Controller Support

STEP– 3

Finally, alltherequiredindividualpartsandthe sub-assemblies are inserted in theassemblysectionbyusingthe “assemble command havingjoint&As-builtjoint ,Rigid group” sub commandsare usedproperly fordesignofthefinalassembly.

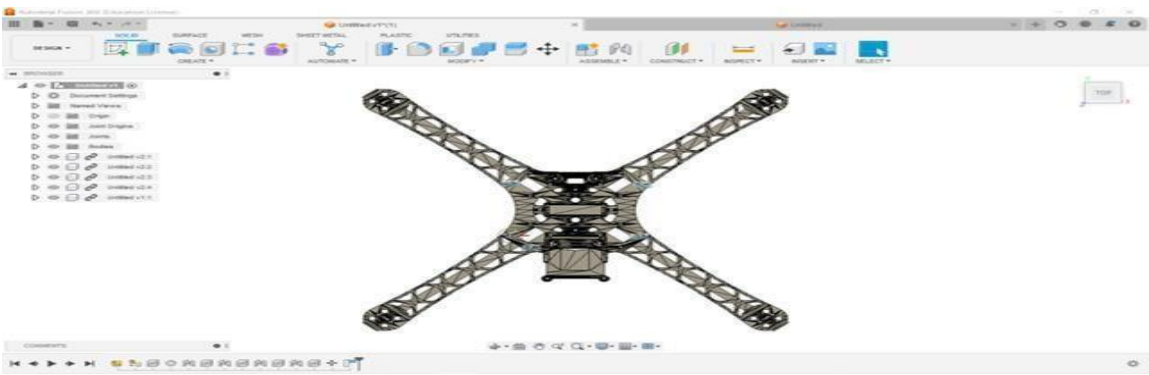


Figure3.4TopviewofDrone

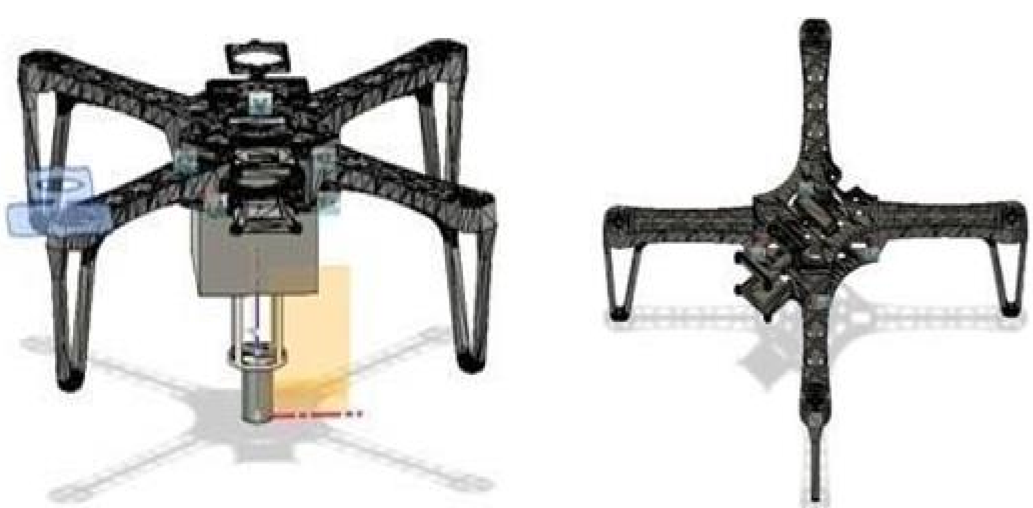


Fig3.5 3Ddesignofdrone

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue IV Apr 2026- Available at www.ijraset.com

IV. RESULTS AND DISCUSSIONS

A 3Dprintedframecanprovidea numberofadvantagesforanagriculturedrone,includingimproveddurability,reduced weight, and potentialcostsavings.Inadditiontoextendingflighttime,a lighterdronecancovermoregroundmore effectively. A seeddispersalsystemforureafertiliserthatincorporatesa storagetankcandeliveraccurateandcontrolled fertiliserapplication, resultinginbettercropyieldsand moreeffectiveresourceusage.Thefertilisermaybe applied evenly andstrategicallyusingthe seeddispersalsystem,whichlowerswaste andincreasesfertilisationefficiencyoverall.

Theweightof dronealongwithpayload(storage tank)consistsof ~1.5kgs. Take-offofdronewithoutpayloadaftermany unsuccessfulattempts givesflighttime of~10minutes,whichisaverageoutcome ofa quadcopter. Onotherside,Testing isdonemanuallywithstoragetankplacing at certainheightFixedand donesometrial-and-errormethodtofindoutspeed requiredforservemotorto seeddispersing.Speedofservomotorwith60 valuegivesoptimumoutcomewithdispersal of seedincloserange Withlengthofdispersal1.27M .Sodronestops atevery~1.30M rangeforseeddispersalforaround2 seconds. Heattachmentsof bothstoragetankwithdroneeliminatedtheaurdinoboardconnectionsasflightcontroller softwareoperatedbygivingspecific commands. This process resulted indecreasingofflighttimeasloadonbatteryis more.Dronewithpayloadresultsinunsuccesfulattempt asthereismis-matchinthrust of1Stmotor,replacing withother
motorandproper ESCcalibrationgives propertake-offdrone.Duration oftheflighttimeis ~6minuteswithureadispersalof 500grams.witha tanaltitude holdof 2 Meters.

1) *Design&Structure*

Lightweightframe usingcarbonfiberor aluminumfordurabilityandreduced energyconsumption. FourbrushlessDC motorswithelectronicspeedcontrollers(ESCs)forstableflight.

Payloadintegration:pesticide/fertilizersprayingtanks(typically1–5liters capacity)mounted with pumpsandnozzles.

2) *PerformanceOutcomes*
3) Flight stability: AchievedthroughPIDcontrollersandGPSmodulesfor autonomousnavigation.
4) Coverage efficiency: Sprayingdronescover5–10acresperhourdepending on tank sizeand battery capacity.
5) Precisionagriculture: Equippedwithcamerasandsensors(NDVI,multispectral)forcrop healthmonitoring.
6) Cost&Energy

Fabricationcostissignificantly lower than commercial agricultural droneswhenbuiltwithlocallysourcedmaterials. Batteryendurance:20–30 minutespercharge,requiring multiple batteriesforextendedfield use.

Advantages

Reduces farmerexposuretoharmfulchemicals duringpesticidespraying. Saves laborand timecomparedtomanualspraying.

Enablesprecision farmingbyintegratingsensorsforcropmonitoring. Environmentallyfriendly whenoptimized for minimalchemicalusage.

Challenges

Batterylimitations: Frequentrecharging orswappingneeded for large fields.

Payload constraints: Limitedtankcapacityrestrictssprayingduration.

Weatherdependency: Windandrainaffectsprayingaccuracyand dronestability.

Maintenance: Requirestechnicalknowledgeforcalibrationandrepair.

FutureImprovements

Hybridpower systems(solar-assisted chargingorfuelcells). AI-basedautonomousnavigationforobstacleavoidance. Largerpayloadcapacitywithmodulardesigns.

Integrationwith IoTfor real-timedatatransmissiontofarmers

V. CALCULATIONS

DesignRequirements(Assumed)

ParameterValue

Payload (pesticidetank)10kg Frame+
electronics5 kg Battery5 kg

Total Takeoff Weight(MTOW)**20kg**

Numberofmotors4

Configuration X-typequadcopter

Thrust Calculation

Rule:

For stableagriculturaldrones:= 2 × MTOW

(Safetyfactor = 2 for maneuvering& windresistance)= 2 × 20= 40kgthrust

Thrust permotor: $\frac{40}{4}$ = 10kgthrust permotor

So each motor mustproduce**minimum 10kgthrust**.

MotorSelectionCalculation

Assumeusing100KV–170KVbrushlessmotors(commonin agridrones).

Exampleclass:100KVmotorwith30–34 inch propeller.

Fromtypicalperformancecharts:

- At12S(44.4V)
- Current≈ 40A–50A
- Thrust≈ 10–12kgper motor

Powerper motor:$P = V \times I =$

$44.4 \times 45 = 1998W \approx 2kW$Totalpower:$2kW \times 4 = 8kW$

BatteryCapacityCalculation

Assume:

- Totalcurrent= 45A × 4 = 180A
- Batteryvoltage= 44.4V(12SLiPo)
- Desired flighttime= 12minutes(0.2hr)

Required batterycapacity:$Capacity = Current \times Time = 180 \times 0.2$

$= 36Ah$Sorequiredbattery:

12S35Ah–40AhLiPo

Energy:$E = V \times Ah = 44.4 \times 36 = 1598Wh \approx 1.6kWh$

ESCRatingCalculation

Each motorcurrent≈ 45A

Safetymargin30%:$ESC =$

$45 \times 1.3 = 58.5A$Select:

60A–80AESC(HVcompatible)

PropellerCalculation

Thrustequation:$T = C_T \rho n^2 D^4$

Where:

- C_T= thrustcoefficient
- ρ= air density(1.225 kg/m³)
- n= revolutions/sec
- D= diameter (m)

Forheavy-liftdrones:

Typicalchoice:

30–34inch carbonfiberpropeller

(0.76–0.86m diameter)

Largediameter→ Higherefficiency→ Longerflighttime

FrameStrengthCalculation

Assumecarbonfiberarmlength = 800mm

Loadper arm: $\frac{20}{4} = 5kg$

Force: $F = mg = 5 \times 9.81 = 49N$

Bendingmoment: $M = F \times L = 49 \times 0.8 = 39.2Nm$

SpraySystemCalculation

Pump flowrate:

Assume spraying1 hectarein10minutes.

Typicalrequirement:

5 L per hectare

For10Ltank:

Covers2 hectaresperflight

Flowrate: $= \frac{10L}{10min} = 1L/min$

Cost Estimation (Approx.)

Total≈ **\$3,000– \$3,500**

FinalSpecificationSummary

ParameterValue	
MTOW20kg	TotalThrust40kg
Motor2 kW class	Battery12S36Ah
FlightTime10–15minutes	
SprayCapacity	10liters

VI. CONCLUSION

Inthisprojectwehavedesigned a DRONEWITHPESTICIDESSPRAYERbySeeddispersalsystemwhichisanarchitecture built aroundunmannedaerialvehicles(UAVs)anda seedingsystemthatmaybeusedtoconstructa controlloopforagricultural applicationswherea DRONEWITHPESTICIDESSPRAYERby Seeddispersalsystemisinchargeofsowingseeds.By doing this,wecanminimisehumanefforttosomeextent,ifnotmuch.Thiswillenablefastercompletionoftheseedingprocessin agricultural fields.Thiswillincreaseefficiencyandimprove accuracywhileloweringlabourcosts.Within thesignal'srange, thisis entirely controlledbytheradiotransmitterandreceiver.TheDRONEBASEDPESTICIDESSPRAYER'sseeddispersalsystem won'toperateproperlyif we go too faroutsideof thesignalrange.

Thissystem maybefurtherdevelopedin a numberofways,includingbysubstitutingotherequipmentorsystemsfortheseeding system.Forexample,ifa cutterisplaced,thecropwillbecut,ifa sprayer moduleisattachedtoa drone,thedrone willbe usedto spraypesticides,andifexpensiveequipmentisprovided,thesystemwill alsoperformscanningofplants,securitypurposes,and inspectingcropdetailswithspecificseeds,fertilizers,andpesticidesaccordingtosoilconditions.Thewirelesssensornetworkbuilt atground levelonthe agriculturalfieldprovidesfeedbackthatis usedto regulatethe applicationprocess.

Droneswillbeusedinalmosteverysectorofthe economy,butdroneusageinthe agriculturalindustryisbooming.Ourcutting- edge platformis a keyto enablingworldclass practicesfora safe,healthyandsustainablefoodsupplychain.

REFERENCES

[1] Prof.B.Balaji,SaiKowshikChennupati,SivaRadhaKrishnaChilakalapudi,RakeshKaturi,kowshikMareedu, DesignofUAV(Drone)forCrops,WeatherMonitoringandForSpraying Fertilizers and Pesticides.,Dec 2018

[2] Prof.karankumarshaw, JagtapKomal Tanaji, NimbalkarAishwaryaSatish,“AgricultureDroneforSpraying FertilizersandPesticides”,Sept2017,InternationalJournal ofResearchTrendsand Innovation,Volume 2,Issue 6

[3] S.R.Kurkute,B.D.Deore,PayalKasar,MeghaBhamare,MayuriSahane,DronesforSmartAgriculture:A Technical Report,April2018,IJRET

[4] U.Euche,S.TAudu[2021]“UAVforagrochemicalapplication“ publishedinNigerianjournaloftechnology (NIJOTECH)vol 40, No5 september2021, pp795-809

[5] P.Smhetre,Deepalisoni,AkshayNerkar,Harshvishal[2020]‘ Agriculturedroneforfertilizerspraying“ published in internationalresearch journal ofmodernizationinengineeringtechnologyandsciences.Volume02,issue06june 2020

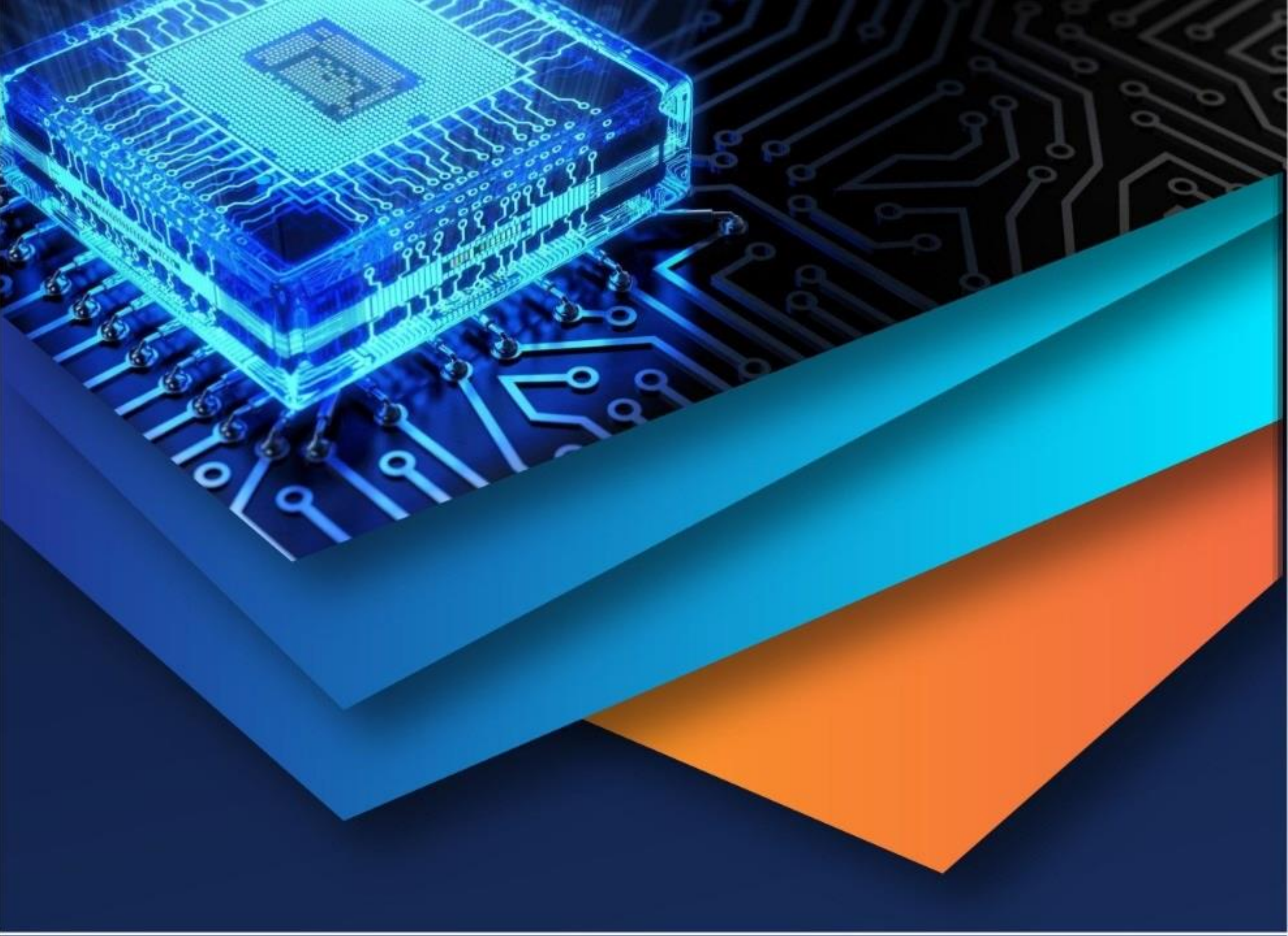
[6] SwatiD Kale,SwatiV Khandagale,ShwetaS Gaikwad,SayaliS Narve,PurvaV Gangal,”Agriculture Dronefor SprayingFertilizerandPesticides”IJARCSSE, Volume5,Issue12,December2015,pp804-807

[7] InternationalJournalofResearchinAppliedScienceandTechnology,‘‘DronesforSmartAgriculture:ATechnical Report’’S.R.Kurkute, B.D.Deore,PayalKasar, MeghaBhamare, MayuriSahane.Vol6,Issue4 April2018

[8] InternationalJournalofEngineeringResearchandTechnology,‘‘DesignandDevelopmentofa Dronefor SprayingPesticides,FertilizersandDisinfectants’’. KaranKumarShaw ,VimalkumarR,Vol.9Issue05,May-2020

[9] RahulDesale, Ashwin Chougule,Mahesh Choudhari,Vikrant Borhade,S.N.Teliµ“UnmannedAerialVehiclefor PesticidesSpraying”,´UG Students,Departmentof Mechanical, BharatiVidyapeethCollegeofEngineering,Navi Mumbai.Professor,DepartmentofMechanical,CollegeofEngineering,NaviMumbai,India.IJSART- Volume5 Issue4 - APRIL201

[10] Faiçal,B.S.,Costa,F.G.,Pessin,G.,Ueyama,J.,Freitas,H.,Colombo,A.,etal.(2014)“Theuseofunmanned aerialvehicles and wirelesssensornetworksforspraying pesticides”Journalof SystemsArchitecture.



10.22214/IJRASET

INDEX COPERNICUS 45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY