

Arnav Gupta

PORTFOLIO

Till Year 2019

Approved by School



Arnav
Gupta

Student (portfolio year 2019)

School Stamp and Principal's Sign

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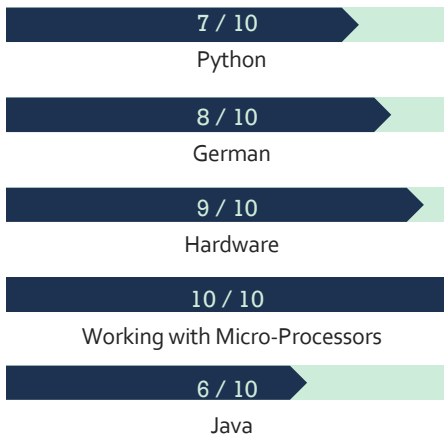
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SKILLS



EDUCATION

Class 10
Amity International School, Saket
2007 - 2019

A2 - German
Fit in Deutsch – Goethe Institute
2017 - 2019

About Me:

My name is Arnav Gupta and I am 15 years old at the moment. I am studying in class 10 at Amity International School, Saket, New Delhi, Delhi, India. My interests are designing IOT ventures and computer programming.

On the left, I have posted my contact information, some of my qualifications and some of the skills that I'm learning which I have even personally rated out of 10.

Below I have shared all my information like the subjects I have studied and the achievements I had until 2019.

Name of subject	Number of years studied
English	10 years
Hindi	10 years
German	4 years
Physics	8 years
Chemistry	8 years
Biology	8 years
Economics	2 years
Civics	8 years
History	8 years
Geography	8 years
Math	10 years
Computer Science	5 years
Sanskrit	2 years



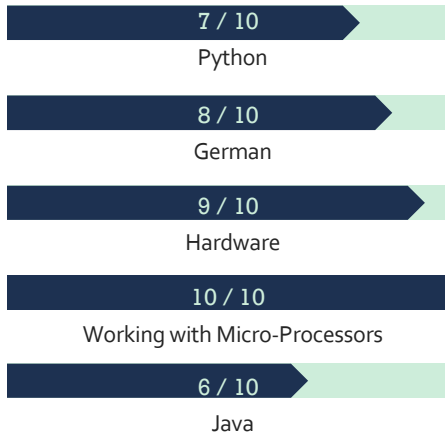
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Activity	Participation
Tech Society	Vice President (2019 - 2020)
School Council	Teach prefect (2019 -2010)
Aerospace Society	Vice President (2019 – 2020)
Youth Power	Tech In charge (2017 - 2019)
Tinker-Fest (School event with association with government of India)	Supervisor
Model United Nation	Information Technology Team
School Council	Vice Cyber Captain (2020-21)

Extracurricular Activities :

Robotics :

- Hygeia** - Hygeia is a smart bin made with Arduino and is capable of opening and closing on its own after sensing presence of a human, segregating waste, purifying water and sending messages when full. Has received awards like 'Bharat Astitva Samman'.
- Pluto** - Pluto is a smart drone made up of KK2.1.5 and PixHawk and is capable of flying a specified path without any human interference.
- Saturn** - Saturn is a miniature of a fully automated farming machine capable of threshing, harvesting, ploughing, winnowing, seeding and even work autonomously. Has received awards in events like 'ideathon'.



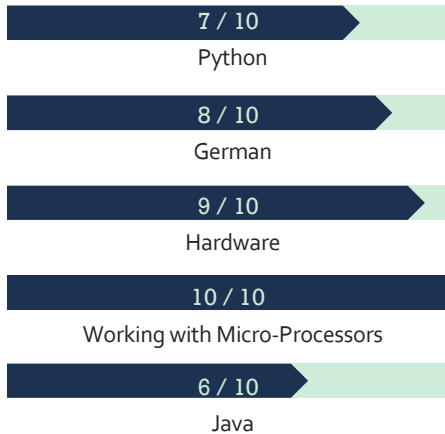
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- Robowar Bot:** A fully functional robot weighing 12 kgs with 4 high torque motors and a roller of 1000 rpm on front for attacking.
- F1 cars** – 3D modeling of F1 cars and 3d printing them with association with F1 in Schools India which further were presented at national level.
- Tourism in India App** – An app with extensive graphics with great features which also was further presented at national level.
- Security System** - This was a home safety system with various measures such as human detection password encryption and many more.

Model United nations:

It a debating event which function like the united nations assembly. I have participated in 'World Health Organization' and 'General Assembly' committees of the above event.

Displays on ATL day:

Organizing showcase in front of various school parallel with government for ATL(Atal tinkering labs – government initiative).

Patent and Copyrights:

2 Apps with Arnav Gupta as the author have been submitted for copyright and a project Smart Bin has been applied for patent with Arnav As the Author.



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SKILLS

7 / 10

Python

8 / 10

German

9 / 10

Hardware

10 / 10

Working with Micro-Processors

6 / 10

Java

EDUCATION

Class 10

Amity International School, Saket

2007 - 2019

A2 - German

Fit in Deutsch – Goethe Institute

2017 - 2019

Social Activities :

Youth power contribution :

It a social initiative through which awareness regarding civic sense and eye care were spread a smart dustbin was also designed by me during the campaign which is capable of detecting human and opening, segregating biodegradable and non biodegradable waste and also send a message when full. I also contributed in going for campaigns and cleaning the market places.

STEM Club Stay backs :

I have been taking stay backs in school and shared my knowledge with other students to help them develop their skills

Orphanage visits:

Participating in visits organized by school for visiting orphanages and helping in donation of food and also get updated with social issues.

Project Citizen:

Again a social initiative took up by our school in year 2018-19 for making a good cause to which I provided technical support.

Some of the below don't have a certification proof and hence have been approved by the school.

These includes various achievements made in competitions or activities at various levels

S.No	Achievement	Level of achievement	Position	Category
1	Bharat Astitva Samman	National - Governmental	Second	Science and Technology
2	Space settlement design competition	Nationals	First	Science and Technology
3	Space settlement design competition	Nationals	Runners up	Science and Technology
4	Space settlement design competition	Asian	Runners up	Science and Technology
5	A1 fit in Deutsch	Certification - Goethe Institute	Certificate of qualification	German Language
6	A2 fit in Deutsch	Certification - Goethe Institute	Certificate of qualification	German Language
7	Robotech Labs	Summer School	Certificate of Excellence	Drone Building
8	Amity International Confluence	Confluence	Certificate of Participation	Computer Science
9	Space	Astronomy course	Certificate of Appreciation	Astronomy
10	British Council	Summer School	Certificate of Qualification	English Language
11	Times of India Challenge	National	Certificate of Excellence	Competitive Examination
12	Negi Sports	Summer School	Certification of participation	Sport - Trekking
13	Buddhism	Religious	Certificate of Qualification	Religious - Social
14	Karate Foundation Of India	International - 8th KYU	Certification of merit	Karate - Martial Arts
15	Karate Foundation Of India	International - 7th KYU	Certification of merit	Karate - Martial Arts

16	Karate Foundation Of India	International - 6th KYU	Certification of merit	Karate - Martial Arts
17	Karate Foundation Of India	International - 5th KYU	Certification of merit	Karate - Martial Arts
18	Karate Foundation Of India	International - 4th KYU	Certification of merit	Karate - Martial Arts
19	Atal Innovation Mission	National - Government	Certificate of Appreciation	Proofs ownership of the invention of Smart Bin
20	Atal Innovation Mission	National - Government	Certificate of Appreciation	Proofs ownership of the invention of Farmers Chum
21	Atal Innovation Mission	National – Government (no-proof)	Certificate of Appreciation	Proofs ownership of the invention of Smart Drone
21	Atal Innovation Mission	National – Government (no-proof)	Certificate of Appreciation	Proofs ownership of the invention of Robot Fight Bot
17	Robotronics	Inter-School	Second	Science and Technology
18	Amity International MUN	Intra-School	High Commendation	Debating
19	Tennis Championship	Intra-Academy	Third	Sports-Tennis
20	Tinkering Fest	Inter-School	First	Drone-Race
21	Vasudha	Intern-School	Third	Science and Technology
21	Hackathon	National - Indian Institute of Technology	Top 50	Science and Technology
22	Amity International MUN	Intra-School	Certificate of Appreciation	Part of Information Technology
23	Design Championship	National (no-proof)	2nd	Science and Technology
24	It wizard and impeccably truthful	Intra-School	Certificate of Appreciation	End Semester Rewards
25	Paper Craft and Head Gear Making	Intra-School	Second	Art
26	Good Chits × 6	Intra-School	Certificate of Appreciation	Various Categories
27	International Master Mathematics Olympiad	International	Certificate of excellence	Olympiad- Maths
28	Participation × 4	Inter-School	Certification of Participation	Various Category
29	JS Harmony Institute of Music	Stage Performance (no-proof)	Certificate of Appreciation	Guitar
30	Google Science Fair	International	Certificate of Recognition	STEM

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Report Cards after the school letters

Class	Test Type	Percentage
5	Half Yearly	85.50
5	Annual	86.10
6	Half Yearly	83.81
6	Annual	84.01
7	Half Yearly	88 (approx.) No data
7	Annual	88 (approx.) No data
8	Half Yearly	86.48
8	Annual	86.65
9	Half Yearly	79.13
9	Annual	78.74
10	Half Yearly	78.31 No data

Hygieia – Smart Bin

Classification of project:

My invention is an upgraded version of a normal bin for storing waste products using robotic and IoT (Internet of things) features. This is, hence, a new product which is an advancement of an old bin - unique in its functionality - that can sense the amount of waste and its type. The 'e bin' can send messages, detect moisture levels, detect motion and calculate filling capacity.

Title of the project:

I have chosen the title 'Hygieia', inspired by the Greek Goddess of Health, which is literally suggestive of the cleanliness I hope to aim at providing through this invention. I have tried to personify the bin that will help us maintain cleanliness around us by notifying us of its contents and its filling status, thereby ensuring that the waste is also hygienic in nature.

Description:



The smart bin has two partitions – one for wet waste and the other for dry waste. The bin has 2 sub-lids along with a main lid which opens when a person arrives near it. The sub lids act as moisture sensors, cleverly segregating the waste on its dry and water laden content. It is not important that both the compartments get filled up at the same time. Whichever side fills up faster, the message clearly mentions that for the attendant to empty out its contents. This bin is ideally suitable for large organisations where manual checking of bins is difficult. For instance if installed in the government organisations, it can send signals to the MCD safai karamchari the moment it reaches 75% of its filling capacity, thereby signalling them to dump out its garbage.

Working:

My invention, a device or a contrivance, is a smart bin that works mechanically, differentiating between living and non-living objects on the basis of their thermal heat, and opens on detecting ultrasonic sensors of human beings.

1. The servo is designed to rotate at an angle of 90 degrees clockwise which opens the smart bin so that the waste can be thrown in and later rotates 90 degrees anti-clockwise when the person (object) goes away from it. The circuit is then broken and resets to default mode
2. The invention has an IR sensor along with IoT components to send a message when the smart bin is about to reach its full capacity.
3. The bin further uses moisture sensor differentiation to distinguish between dry and wet waste including water. This enables the bin to act smartly and segregate the wastes into dry and waste categories.
4. The inner part of the smart bin has another ultrasonic sensor attached to it which senses the distance from the top, and whenever distance reaches $\frac{1}{4}$ of the smart bins total length, it sends a message through IoT
5. Many experiments were done to find an appropriate code that gave a suitable output. Finally, a fully functional prototype was made.

```
1 //  
2 // IR sensor, ledPin  
3 //  
4  
5 int ledPin = 13;           // choose the pin for the LED  
6 int inputPin = 2;          // choose the input pin (for PIR sensor)  
7 int pirState = LOW;        // we start, assuming no motion detected  
8 int val = 0;               // variable for reading the pin status  
9  
10  
11 void setup() {  
12   pinMode(ledPin, OUTPUT); // declare LED as output  
13   pinMode(inputPin, INPUT); // declare sensor as input  
14  
15   Serial.begin(9600);  
16 }  
17  
18 void loop(){  
19   val = digitalRead(inputPin); // read input value  
20   if (val == HIGH) {           // check if the input is HIGH  
21     digitalWrite(ledPin, HIGH); // turn LED ON  
22     if (pirState == LOW) {  
23       // we have just turned on  
24       Serial.println("Motion detected!");  
25       // we only want to print on the output change, not state  
26       pirState = HIGH;  
27     }  
28   } else {  
29     digitalWrite(ledPin, LOW); // turn LED OFF  
30     if (pirState == HIGH){  
31       // we have just turned off  
32       Serial.println("Motion ended!");  
33       // we only want to print on the output change, not state  
34       pirState = LOW;  
35     }  
36   }  
37 }
```

```
1 void setup() {  
2   pinMode(7, INPUT);  
3   Serial.begin(9600);  
4   pinMode(13, OUTPUT);  
5 }  
6 void loop() {  
7  
8   Serial.print("IRSensorip ");  
9   Serial.println(digitalRead(7));  
10  if(digitalRead(7)==0)  
11  {  
12    digitalWrite(13, HIGH);  
13  }  
14  else{  
15    digitalWrite(13, LOW);  
16  }  
17 }
```

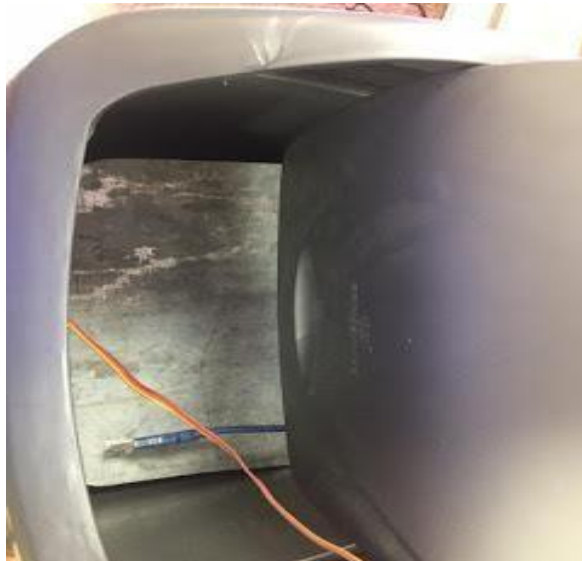
```
1 root=postmaster  
2 mailhub=smtp.gmail.com:587  
3 hostname=raspberrypi  
4 AuthUser=AGmailUserName@gmail.com  
5 AuthPass=TheGmailPassword  
6 FromLineOverride=YES  
7 UseSTARTTLS=YES
```

```
1 import pygvoicelib
2 number = raw_input('number:')
3 txtmsg = raw_input('message:')
4 client = pygvoicelib.GoogleVoice('name@gmail.com',
5 'asdfghrwithjtrh',
6 'kJEozF_Qmrg3t0Z_a5dNQtFHCv5aTdUxb7WvcH8g3PV929VMDemHG6W0VpbN204E6FzMOYAP
7 hPjaEHr926j01G0N3RGhQLXqePwfglbXnA2n7XpUoph0k5qzt0yv2fYM7eYgtVCYe08tx7qb0QAAAsA
8 AAB2706GTL2pJsuuPKH4Z3cpbJFqjFLZrfhok1b11pIMDrEDyp2gIc0VdPEt8JEMx7oY9hHJeJc0QZY
9 ndBJ0ubuo0bDwqx187QMy900ankWR81y8vIB17769eVNB0a3224U8DLZLUWqP044hfsDK5Mq',
10 'L6tph1268j=4j0cftZ0uNYeb+sk=')
11 client.sms(number,txtmsg)
```

Components:

1. Arduino – Arduino is a microprocessor which is like the brain of the robotic section of the inventions. The possible replacements are raspberry pi, NodeMCU, MSP430, Teensy 3 and open source microprocessors. I chose Arduino for its user-friendliness and its easily programmable aptitude in Java, which is my strong area.
2. Motion sensor/PIR sensor- It detects body heat (infrared energy). This component helped me sense movement and differentiate between animals, plants and non-living things. The possible replacements for this are – ultrasonic sensor, IR sensor, VCC camera and other components which can also sense distance or capture images. It is one of the most widely used sensors, owing its distinguishing property between living and non-living things to simple programming.
3. Moisture sensor- As the name suggests, it is responsible for differentiating between wet and dry waste. The sensor can be replaced by water sensor, weight sensor or any other sensor with the capability of calculating moisture/ humidity/ density and weight parameters. I chose this for its accuracy.
4. Servos- Servos are high power motors directly accessible by microprocessors. They can be replaced by high torque motors. I used these because of its reasonable pricing and user-friendliness.

5. IR sensor- This is used to sense when the bin reaches its full capacity. This can be replaced by any range or weight sensor. I used it because its cheap and doesn't get spoilt easily.
6. GSM module/ Bluetooth module/ HC05- They are used to send mails/ messages. These can be replaced by any Sim with a Bluetooth compatible device. I used it because of its high speed.





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Novelty:

Dust Bins used by various organisations and communities up until now were only colour designated for recycled and non recycled uses. They not only lacked a mechanism to allow the person to throw the garbage inside it but also could not warn over spilling signals to its care takers, thereby letting it become a breeding ground for mosquitoes and diseases. People using these bins cared less to aim its container and more often than not littered the wastes around them increasing the problem of waste management and pollution.

My invention is novel in its approach as it is created to combat the adverse effects on health that crop up because of carelessly disposing waste. Firstly, the project incorporates robotic features such as motion detection, moisture detection and filling up detection, thereby leading to a conscientious approach for the people of our nation. Secondly, its IoT features (send a mail or send a message) work without any human interference.

Existing projects and their differences:

I am aware that even though smart bins already exist but none of them have all the features as my invention does. My invention is unique because it does 3 tasks in one namely segregation of waste, transmitting a message and detecting a human in just one project- Hygieia. Furthermore, I propose to incorporate composting in my smart bin which will enhance its usefulness and create manure.

Impact:

The invention is a development of bins which due to its robotic features is able to open on its own with the help of a motion sensor, distinguish between wet and dry waste with the help of moisture sensor and finally send a message when full with the help of gsm module.

Limitations:

As of now, a limitation I encountered is – whenever a mixture of wet and dry waste is thrown together, the bin treats it as one product and throws it on the side of the container with average moisture. This, however, leads to an issue in rare situations. Currently, because of financial constraints and lack of funding, I used a reasonable motor which is not segregating the product into separate compartments. A relatively high voltage motor involving higher costs would most likely fix this issue.

Present stage:

A fully functional and successfully tested prototype of the product 'smat bin' is ready. The product opens and closes on its own, sends a message when it is about to get full and finally segregates wet and dry waste.

A power team of 2k17 (Pic Civic) of Amity Saket implemented this Smart bin concept in all Amity branches and universities. The bin has been appreciated by the Ph.D. chamber of commerce and was awarded the Bharat Astitva Samman

New Innovation

We have constructed a smart bin that can segregate biodegradable, nonbiodegradable and metal waste and purify water. The bin has 2 containers – one for water and other one for solid or semisolid waste.

Working of the first part which is for water purification-

There is a main lid which opens on sensing a human with IR-sensor, the bin also has a sub-lid(made up of a molecular sieve[a lid that allows only gas to pass through it]) opens and when the person goes away both the main lid and the molecular sieve close. So now an IR sensor is continuously detecting the whether the bin is about to get full or not. When this section is almost full, a message is sent to the registered mobile number, the opening of the bin is disabled and the nichrome wire present at the bottom of the bin starts heating up which boils the liquid that was thrown inside. When water boils the water-vapor passes through the molecular sieve and after cooling down the water vapor forms clean and purified water above the sieve. Now this water can be collected and is ready to use. The rest of the left-out material are impurities and needs to be disposed. The working of rest of the parts has been already explained.

Smart Drone - Pluto

Pluto is a smart drone with multiple smart features that have been thought about multiple times in the past.

Some of the important aspects are listed below

1. The drone is capable of aromatically delivering the product to a given place with the help of a specified path. No human interference is required in this except for entering the delivery location.
2. The drone can fly at a height up to 500m-1000m. Pluto can also be traced during its fly with the help of a frequency of 433 mhz.
3. The drone gives voice outputs which helps in communication with user.
4. In any situation when drone is in a dangerous area , the drone can be instantly called back to the place from where it started.
5. The best part of this project is that it's the cheapest of its kind. It only costs 28,000 INR.

The drone has a camera to intelligently sense locations around it and take decisions on what to do. For example, if there is a waterfall I the path the drone will try avoiding it by taking a slight drift ,etc. The drone is built up of the following material- fly-sky receiver and transmitter, 433 megahertz frequency generator and tracer, pix hawk flight controller, KK2.15, Li-Po battery, 1000KV brushless motor and finally the ESC or electronic speed controller.

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Some portion have been blurred to avoid copying of the drone



Saturn – Farming Machine

Currently, the most advanced farming machine is the combine harvester. However, it is only capable of doing reaping, threshing and winnowing. Farmers have various tasks except for the three tasks mentioned above. The various tasks of farmers include ploughing, seeding, mixing of manure, levelling, weeding, reaping, threshing, winnowing, and making manure out of waste products. Thus, the combine harvester is a little help to farmers.

The machine that we have designed does all the mentioned tasks along with some more features which include – land mapping, IOT, machine learning, conversion of husk to cancer medicine and self-driving. The machine can automatically do all the tasks just by an input of the dimensions of the land. Hence, farmers don't even need prior knowledge of these technologies.

The machine distinguishes between plants, humans and non-living objects with the help of a thermal camera, the images of which are processed by the programming language of python. Raspberry Pi 3 B+ is the brain of our project and controls all parts of the machine, from the motors to the IOT. This module is also programmed with python.

Ploughing is done by a back structure that rotates up to an angle of 45 degrees and is levelled parallel to the ground whenever required.

The second structure is made for digging holes to plant seeds it has the same working as the plough. Since the movement in both the tasks is only a maximum of 45 degrees therefore servos are used to make the price cheap.

The process of harvesting is done with the help of a roller attached in the front of the machine. At the back of this roller is a sloping plate with grain sized holes. The roller internally separates and loosens the grain from the husk. Once on the slope, the seeds all down through the holes while the husk gets stored in the compartment above. Hence, the husk and the grain are separated.

For mixing of manure in the soil, manure can be kept in the funnel responsible for depositing seeds and then levelled with the back part.

The machine has a good protection for wheels to maintain balance of the automobile while cutting crops. Through python we have developed libraries including OpenCV which helps to differentiate between humans, plants and non-living objects. Thermal camera is used to click images which are further processed. We are doing land mapping with the help of google API which uses 39 satellites to receive accurate data. Now we conclude our project by sharing the price of this model which is only Rs. 6,82,069/- (including profit margin of 14%) which is less than half the price of a combine harvester present in market today which costs in between 15 – 20 lakhs.

comparison between the modern and new machine (size 9*9 feet)		
component	modern	advanced
engine	1,15,000(including motors)	75,000(including drive motor)
tyres	25,000	20,000
others	9,85,000	4,70,000(along with rest motors)
front part	75,000	60,000
ploughing	0	50,000
total	12,00,000(least price possible in market)	6,82,069(with profit)

