

Farmer Pest Repellent Based on Frequency Technique

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Chapter 1

Introduction

Bangladesh is known as one of the highest agricultural producing countries with a huge amount of cultivable land. Bangladesh has many fertile lands in which different varieties of crops grow well. Due to geographical location and climate conditions, the fields of Bangladesh are more useful for agricultural purposes.

Many kinds of crops are cultivated in our country. There are two kinds of crops which are cultivated in our country- food crops and cash crops. Most of the land is used for rice cultivation. Around 50% of people in our country work in agriculture. More than 70% of the land is dedicated to cultivating yield. Rice, Jute, Tea, Vegetables, and fruits are cultivated in our country. Rice is the main staple food in Bangladesh.

Bangladesh is the fourth largest rice-producing country in the world. Despite having a huge amount of paddy yields, many reasons cause the loss of the farmer's profession. The average size of the land has decreased, less than 0.6 hectares. The percentage of cultivated land in Bangladesh was 70.69%, which was reported in the year 2018. One vital reason is the existence of pests that are very harmful and very difficult to control. In the meantime, various types of steps are being carried out by farmers to control the pests.

So, from the above perspective, we want to create an efficient and effective system that will be a good alternative to pesticides. We want to make a microcontroller based efficient system that will repel pests with the help of frequency. Also, this system will help farmers to control harmful pests so that they do not have to use pesticides. In this work, we will use such a level of frequency that it will drive away the pests and keep our cultivable land free of these harmful pests. Here a wide range of sensors will be used to make the system autonomous and will need less maintenance and manpower.

1.1 Motivation

As there are different types of harmful pests like insects, rats, birds, etc which are damaged largely in our cultivable land, our country is not getting the desired amount of grain that they are expecting. Farmers use different types of pesticides to eliminate the effects of insects on our country's grains. As a result, the quality of grains is lost and, at the same time, money is being spent on buying pesticides again and again, yet it is seen that pests can not be completely repelled. Pests cannot be avoided, as they are living things that continue to develop according to their nature. We only control it but cannot eliminate it. Pesticides often have harmful effects on the field. Therefore, farmers are not getting enough grain. That is why the upside of the goods appears. The price of everything goes up. As a result, the people of the country suffer a lot. If we notice, in the context of the current situation, it will be seen that, from the end of the last year, since Ethiopia, Kenya and Somalia, and some other places were attacked by Pangal. As a result, a huge amount of grains are affected. At the beginning of this year, Pangal attacks in Pakistan caused severe damage to crops. Pangal is a kind of grasshopper that attacks crops of land by eating crops. When Pangal attacks the field, farmers are at a loss. It becomes a nightmare for them. The yield is decreasing as a result, the cost of every good is increasing for this reason. Now the overall way is to snatch everything we are thinking of to make something new to benefit the farmers as well as to get the full quality of grains and to keep the cost of goods constant.

Farmers made tools which they used to control the pests until now they use some manual procedures. Mechanization constantly progressed. Laboring instruments became self-automated. Human work enhances brightness. Nowadays, if we see them, we find a lot of farmers who are still using handbook tools and ancient tools. If farmers started to obtain the methods of how valuable our present technological progress is and if they take such progress into progress and benefit to control pests, then it will be satisfying.

Here the main objective of our project is-

To implement a tool: an automatic farmer pest repellent, so that farmers can produce grains without using pesticides and using frequency to keep grain clean from harmful pigs and animals and by which farmers can control the endangerment of a large number of insects, birds, and Rattus pests. Technological pest repellent tools are the solution to all the difficulties. That is a mechanism that consequently reduces farmer pests mechanically. This device is based on microcontroller technology and a few sensors. On account of this technology, which is something to help to control pests, we are hopeful that farmers have solved this problem. As we know, grain losses are caused by harmful pests. This device can control the pests and it would be easier for the farmers. And they are not used as

manual machines anymore. The more profit the cultivators get in the case, the more we think of creating something new.

1.2 Social Issue

The use of pesticides is harmful to our human beings as well as crops. The use of pesticides may result in irritation to the eye, nose, and throat. It causes damage to the central nerve and kidney and increases the risk of cancer. Besides, pesticides used also cause headaches, muscular weakness, and dizziness. So those who are coming in touch with pesticides may be affected by pesticides. That's why we think that building something new to overcome this situation is because it is very important to keep our farmers healthy and footy as they play an important role in our economy. Our proposed system is the solution to all the above problems as it has no social impact.

1.3 Environment and Sustainability

We do not have any negative impacts on the environment or sustainability aspects of our work. We hope that our proposed system will be helpful for our farmers and the economy of our nation, as well as be helpful for us. We hope that our work does not harm the environment at any rate. The economic perspective of our work has no negative impact either.

1.4 Related Works

We have seen many works that address pest repellent systems to suppress various insects, rats, and birds which are very harmful to our environment, our cultivation field, and our economy. Previous works are based on different approaches, like using frequency, using different types of sensors, using IoT, and microcontrollers. Each work poses a good contribution to its relevant field, but none of them are fully accomplished. We will go through them in Chapter 3.

1.5 Limitation of Previous Works

There are some previous works we have seen so far and they have a lot of limitations. We have seen that most of the time they use Wireless Sensor Network (WSN), which is an emerging network system monitoring real-time data. It follows the pattern recognition principle. It helps monitor real-time data to identify pests' introduction, which kind of pest it is, and the symptoms of the problems. But at the same time, WSN has some drawbacks too. It has limited energy and corporate safety. Also, it has limited software and hardware features and security features for routing purposes. When we read the previous paper, we also saw that they used a PIR sensor which is called the detector of infrared light from an object. Actually, in all of the cases, they made a prototype and they desired to make a complete tool further.

1.6 Problem Statement

This work mainly focuses on the repellent of pests for a particular field (i.e rice field, corn field) most effectively and efficiently. In this work, we aim to construct a solution that will not be limited to only insect repellents but also will be able to provide a good result on the harmful animal and bird repellents for corn fields. For this purpose, various data about insects, animals, and birds with various backgrounds, their hearing range, and how they infect a particular crop will be collected.

1.7 Our Proposed Method

The method for our project is:

To implement a tool, an automatic farmer pest repellent, so that farmers can produce grains without using pesticides and using frequency to keep our grain clean from harmful pigs and animals, and by which farmers can control the chance of losing insects, birds, and Rattus pests. First, here we go through the literature review and then we want to make a design for our proposed system. After finishing the design, we will work on preparing tools and instrumental equipment. When our tool is ready to use, we must go through the trials section.

1.8 Organization of The Report

The project report structure is the following:

Chapter 2 deals with Background and Related Works related to our work. Here we have presented all the works that address problems related.

In Chapter 3 we have discussed the proposed solution to our work. In this chapter, we have summarized the model of our project and its core parts in detail. Chapter 4 handles the schedule and budget needed for the project. Finally, we conclude our report with a conclusion through chapter 5.

Chapter 2

Background Studies

An account of complete our work we had to studies about several kind of pests like insecticides, animals mostly known rat which plays in important role to damage our crops and some harmful birds pig which are also harmful for our crops. We have to know these pest life cycles, how they harm our crops, the processes,symptoms of them, their hearing range, how much they bear and can not bear etc.

2.1 Scirpophaga incertulas (মাজরা পোকা)

Paddy, wheat, and corn are more affected by Mazra insects on these grains.In the case of grain production, 3 types of Mazra insects do more damage. These are::

- হলুদ মাজরা (Scirpophaga incertulas).
- কালো মাথা মাজরা (Sesamia inferens)
- গোলাপি মাজরা (Chilo polychrysus)

These insects are named after the insect's color. Although there is some difference in this shape and life cycle, the type of damage and the method of suppression are the same. Below is a description of this insect as it mainly attacks yellow turtles.

Mad yellow mazra is a type of myth. Mouthful female insects have two black spots on their wings.Boiling in the middle of the male moth is not obvious. However, there are 7-8 vague drops on the back of the fan. If you see a pile of mazra insect eggs in a tree, you will understand that there is a possibility of damage to the tree.Yellow Mazra insects have a light gray coating on their eggs.All the Mazra insects are nocturnal. During the day, these are hidden under the leaves. They only move in the dark at night.They are all attracted to light.

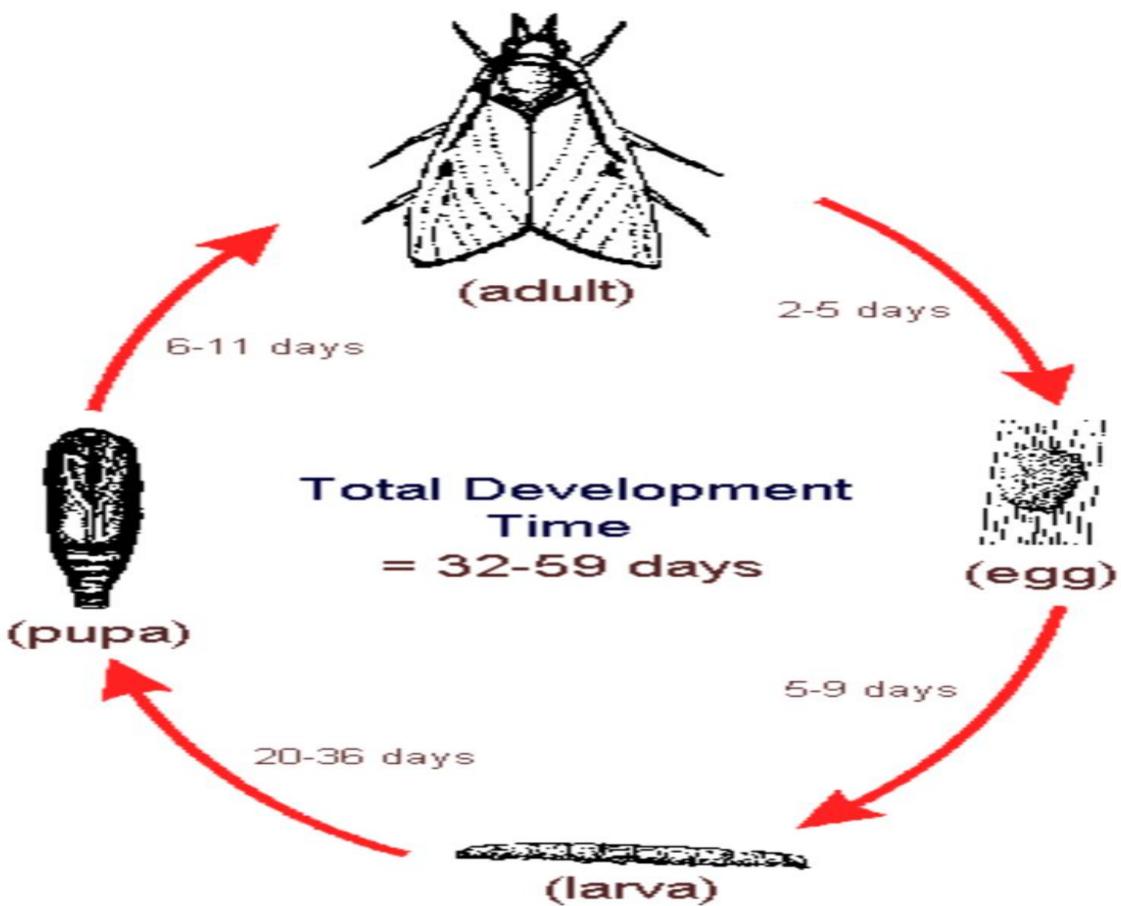


Figure 2.1: Life cycle of Scirphophaga Incertulas. [26]

(মাজরা পোকার জীবন চক্র)

Type of damage:

Insects start eating from the inside of the stem and gradually cut off the roots of the dig leaves of the tree. As a result, the sig leaves die. It's called 'Dead Dig' or 'Deadheart'. When attacked by Mazra insects, the stem is infested with worms, its food patterns and faces, or the outer color of the stems fades and there are holes for the worms to come out. After the larvae hatch from the eggs, they slowly enter the stems. In the early stages of moths, many pink and black-headed Mazra moths can be seen gathering in a bunch of rice. But yellow Mazra insects and pupae can be found anywhere in the stems. If you see a lot of Mazra insect moths around the light, then it must be understood that the myths have started laying eggs in the fields.



Figure 2.1: Rice Stem Borer. [27] (ধানের হলুদ মাজরা পোকা, বালাই এবং রোগ)

Scope of Damage:

Studies have shown that about 70-80% (percent) of the crops in the paddy field can be destroyed if the midge insects are not controlled in time.



Figure 2.1: Rice Stem Borer. [27] (ধানের মাজরা পোকা) Smart Agricultural

Favorable Environment :

In general, the infestation of these insects intensifies at the beginning of Chaitra and lasts till the months of Baisakh Jestha. In high-yielding varieties, these insects attack more. If high doses of urea fertilizer are applied maximum temperature is 18-30 degrees celsius and in all the stages of rice if the temperature is not more than 35 degrees celsius. A warm and humid climate i.e. 80-90% relative humidity is suitable for increasing the number of these insects.

2.2 Rattus ()

In the case of grains, various insects are as harmful as rats.

What it does:

Rice land rats cut implanted weeds. They also cut down the little corms. In the preparing phase, they suckle on grain panicles. On the contrary, during the ripping phase, they suckle on flour paddy grains.

Why and where it occurs:

Rats are getting into low fields inundated with paddy crops. The seasons both wet and dry are commencing for rat production and damage to the crops. In fed rain rice grains rats have their largest impact in the moist condition. The accessibility of food, shelter, and water are the elements that provide ideal situations. The existence of reedy accouterments also activates their evolutions.

Rice pests fees at night with large activities of darkness. During the day, they were found between vegetation and weeds. At the fallow time, they make use of main channels and rural areas gardens as the primary domain. At cultivation time 75% of them are tunnels along the bank. Maximum cultivating time 65% of them are in paddies.



Figure 2.2: Rattus (ইঁদুর) [30]

How to identify:

losing hills, losing plants, grains, and panicles, cutting of stem against the order, losing developing kernel, cutting young kernel, tillers cutting down at a 45-degree angle, showing delay at plants growing, eating and developing ripe crops.

Check pests' presence in paddy lands. Cut tillers, and a working cavity surrounding the lands. If possible identify species to catch that pest.

As per we know Rattus is the main agricultural pest across the island, mainland Southeast Asia. In paddy cultivation areas on account of this 10 to 20% of grains are lost. In the canal areas, the losses are reported as 30-50%. Large ranges of losses are seen where triple graining is practiced. Because rat density there is very high. There are reports that in Malaysia rates are causing losses of 6 to 11%. In Indonesia, 17% of planted regions are damaged due to this species.

Most of the time rats are about 10 cm from the ground. Mr. Cut the stem at the top. The rat always cuts the stem of the paddy plant diagonally at an angle of 30-45 degrees due to which the stem of the paddy bends. When the sheaf of paddy or wheat comes out, the rats

sometimes bend the sheaf of paddy or wheat and cut only the sheaf. Sometimes rats cut rice into pieces just to keep their teeth sharp and normal, or to build a nest. In the middle of the stalk of the upper part of the stem from which the leaf grows from the stem of the rat rice plant. Mr. Eat the soft part with juice.



Figure 2.2: Rattus (ଇନ୍ଦୂର) [30]

Hearing Range:

Rat: Approximate range: 200-76,000 Hz

Upper range: 76 kHz

2.3 Birds (পাখি)

Some rice-eating birds include:



Figure: 2.3 Eurasian Tree Sparrow [28]

(*Passer montanus*)



Figure: 2.3 Chestnut Munia [28]

(*Lonchura malacca*)

What it does:

Rice pest birds eat rice crops and cause not filled panicles that are called ‘Whitehead’. This kind of pests either compress the crops at the time of the milky stage or eat the full crops when it is matured. Then the destruction shows milky whitening things which are covered by the crops.

Why and where it occurs:

Bird pests become an issue from the yanking stage. When the paddy plant is already growing and filling in crops till harvesting. Some birds will breastfeed off of the panicles by either cultivating next to them, coming to rest on nearby targets, or eating the fallen crops on the floor when lands are collected. Such kinds of species are mostly found at that time.

How to identify:

It will check the milky matter in eaten crops. For whiteheads according to removal crops. Notfills panicles also caused stem borer. An account confirming that all crops are junky. All the crops in the pancakes are pulled up very frequently.

Why is it important?

Birds and pests eat plants in the milky phase of the crops. The harm caused on account of settling the birds in the panicles, as a result, some of the crops are lost.



Figure 2.3

White-Bellied Munia^[28]

(Lonchura punctulata)



Figure 2.3

Scaly-Breasted Munia^[28]

(Lonchura leucogastra)

Hearing Range:

Birds : Approximate range: 1 kHz

Upper range: 4 kHz

2.4 Squirrels (କାଠବିଡ଼ାଳି)

Squirrels are a non-insect pest. It is not harmful to rice corn. It acts as a rice pest removing agent. But plants are affected by Squirrels. It harms large gardens that may be vegetable gardens or fruit gardens or flower gardens.

There are three types of squirrels. They are. Gray Squirrels, Black Squirrels, and White Squirrels.



Figure 2.4 Squirrels [29]

They have an affection for natural fruits, fresh vegetables, and flowers. Usual squirrels have long been problematic for house gardeners. These clever squirrels yank geraniums from the opening carton and pick off close-by ripened fresh tomatoes from their creeping plant. They clean out apple trees like an occupational binder. Although their hunting can occur at any time of the year. It often attacks in late summer and early autumn. They are energetic, especially in late summer and autumn. They stock up for the winter season. Squirrels don't hibernate. So they are below ground, pantries play an important role in winter storage. They have vital learning for storing food, which helps them in future cultivation. The squirrels which in color grays, store food by hiding it in a breakup fashion surrounding their region. Sometimes they destroy flowers.



Figure 2.4 Squirrels [29]

Squirrel damage in the garden:

They dig bulbs at the time of autumn. They dig to eat the bulbs and also use ready holes to stock their nuts. The major sign of them is missing or destroying grains in the garden land. Squirrels steal fresh ripe food, vegetables, and fruits. Especially mushy and tender produce like cucumbers, tomatoes and melons, and also peepers. Sometimes they do not eat the full foods.

If you are planting vegetables or others in a pot, may observe that anyone digging is surrounded by the pot. Squirrels are known to search for insecticides or other things in pots. They may uproot seeds in that way. Squirrels not only attack your garden but also can act as bird feeders. If you notice that your bird's food is vanishing then that's for sure that you have a squirrel's issues.

Despite all of the damage by squirrels, they are helpful for farmers' pest repellents. Because they eat insecticides.

Hearing Range:

Squirrels : Approximate range: 113 Hz
Upper range: 49 kHz

Chapter 3

Related Works

We have seen many works that address repellent in the fields. Previous works are based on different things. These works are done with many constraints. Each work poses a good contribution to its relevant field, but none of them are fully accomplished. We will go through them in Chapter 3.

Chapter 4

Proposed Solution

In this portion, we have summarized the model of the project and its core parts in detail. We have explained the motivation behind each block and in which manner it affects the system. We hope that our proposed system will be helpful for us.

4.1 Proposed Methodology Diagram

The proposed methodology is given through the following diagram according to these steps.

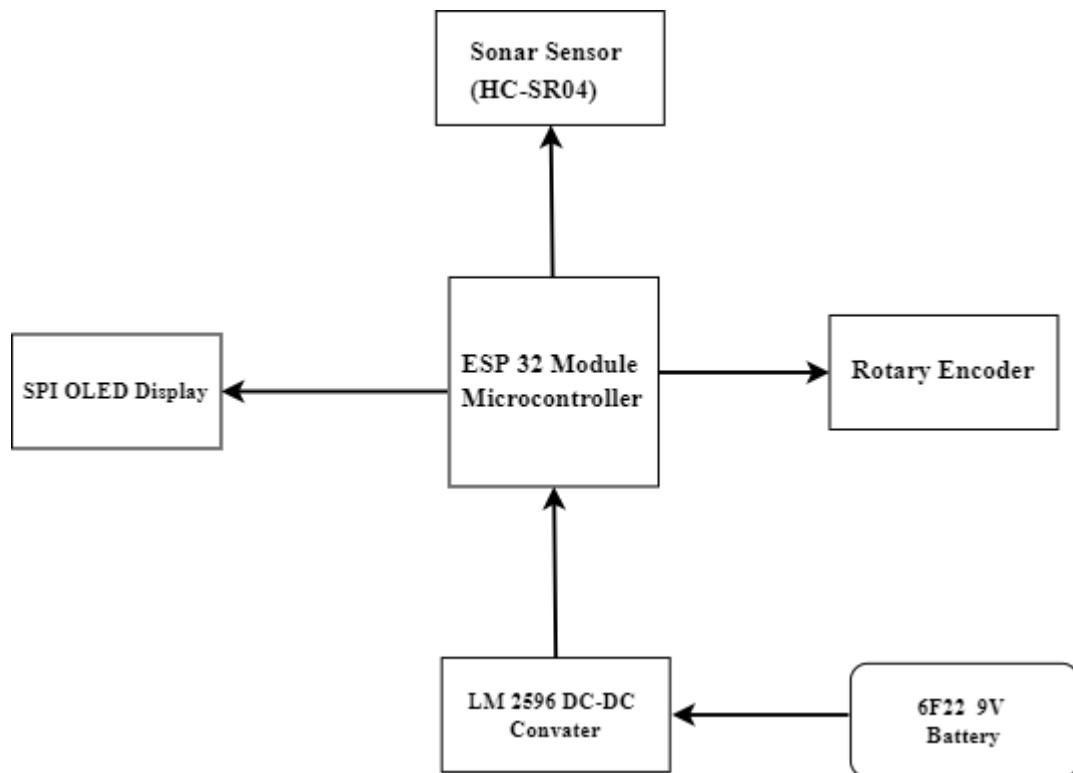


Figure 4.1 : Proposed Diagram

Chapter 5

Time Schedule and Budget

5.1 Time Schedule

Tasks	January	February	March	April	May	June
Brainstorming						
Topic Selection						
Background & Related Works Study						
Idea Generate						
Proposed Methodology						
Budget & Tools Selection						

Figure 5.1 Expected Time Schedule

5.2 Budget

Instruments	Possible Prices
DC-DC Power Step Down Module LM 2596	100/=
ESP32 Wifi Bluetooth Module (Microcontroller)	570/=
OLED Display Blue	390/=
Rotary Encoder Shield or Potentiometer	120/=
Sonar Sensor HC-SR04	90/=
6F22 9V OTV Longer Lasting Battery	45/=
Female to Female Jumper Wire of 40 Lime-20 cm	80/=
Total	1495/=

Figure 5.2 Budget Table

Chapter 6

Conclusion

A rice repellent machine is a machine that is of use to repel pests for the farmer beyond one's control and formulate all pests. This device is in the form of microcontroller technology with some sensors. Afterward, in the depth of the matter, the potency and satisfaction of this device numerous and large utilize worth. Especially, for our farmers, if the crops are secured from harmful pigs our farmers will gain the highest harvesting operating payback. The supply of crops will be steady so that the government does not have to import those crops from far and wide. The zonal saving will boost. And as a purchaser, the price of food may fall because the food supply is strong. To protect the crop from insects, and animals or to protect them from attack, if we allow them to exceed the limit of audibility, then they can't attack our crops. If we give them a frequency beyond their audible capacity they will leave the place unable to bear it.

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Appendix

Complex Engineering Problem Solving

Here Complex Engineering Problem (CEP) mapping are briefly described according to their corresponding Course Objectives and Program Outcomes.

How Ps are addressed through the project and mapping among Ps, COs, and POs:

Ps	Attribute	How P's are addressed through this project	C O s	P O s
P1	Depth of Knowledge Requirements	Our Project has a theory-based understanding formulation of engineering fundamentals requirements (K1, K3), statistics and specialist engineering knowledge (K2, K4), IoT technology (K6), and engineering design part (K5).	CO1 CO2	POa POl POb POc
P2	Range of Conflicting Requirements	Our proposed system has some conflicting issues. If we want to control insecticides that are parasites, 2nd level eaters survive by eating parasites. And again 3rd-level eaters survive by eating 2nd-level eaters So there is a conflict in our environment. And lose our ecosystems diversity.	CO4	POg
P3	Depth analysis required	To implement our proposed system we need to analyze different pests' details, their hearing range, how they actually damaged our crops and lands, their life cycles, their accommodation, and also limitations of the previous works.	CO2	POb

P6	Extent of stakeholder involvement and conflicting requirements	We need to communicate with our group members, farmers, agriculture specialists, and supervisors with widely varying needs. All of us play as stakeholders here. We need to communicate properly with each other in order to implement our project.	CO6 CO8	POi POj
P7	Interdependence	Our project involves interdependent components such as data collection etc. Individually read multiple papers to find the problems and their relevant solution. Data is collected by team members. We need to have project management skills to prepare a proper timeline and appropriate budget.	CO3 CO6 CO8	POk POi POj

How As are addressed through the project:

A's	Attribute	How As are addressed through the project
A1	Range of Resources	Our project needs to engage diverse resources including equipment, money, information, and technologies.
A2	Level of Interaction	The level of interaction among the group members has been very good when it comes to making it easy in our project.
A3	Innovation	This project needs to be updated with innovative and creative ideas to improve the performance of sensors and tools.
A5	Familiarity	We have some difficulties. If we want to develop our tools smartly, we may face net issues, proper wifi connections, and other problems.