# IOT BASED SMART CROP PROTECTION SYSTEM FOR AGRICULTURE

**IBM PROJECT REPORT**

*SUBMITTED BY*


| | |
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**BACHELOR OF ENGINEERING**

***IN***

**ELECTRONICS AND COMMUNICATION ENGINEERING**

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# INTRODUCTION

## 1.1 PROJECT OVREVIEW:

Crops in farms are many times ravaged by local animals like buffaloes, cows, goats, birds etc. this leads to huge losses for the farmers. It is not possible for farmers to barricade entire fields or stay on field 24 hours and guard it.so here we propose automatic crop protection system from animals. This is a microcontroller based system using PIC family microcontroller. The microcontroller now sound an alarm to woo the animal away from the field as well as sends SMS to the farmer so that he may about the issue and come to the spot in case the animal don't turn away by the alarm. This ensures complete safety of crop from animals thus protecting farmers loss.

## 1.2 PURPOSE:

Our main purpose of the project is to develop intruder alert to the farm, to avoid losses due to animal and fire. These intruder alert protect the crop that damaging that indirectly increase yield of the crop. The develop system will not harmful and injurious to animal as well as human beings. Theme of project is to design a intelligent security system for farm protecting by using embedded system.

# LITERATURE SURVEY

## 2.1 EXISTING PROBLEM:

The existing system mainly provide the surveillance functionality. Also these system don't provide protection from wild animals, especially in such an application area. They also need to take actions based on the type of animal that tries to enter the area, as different methods are adopted to prevent different animals from entering restricted areas. The other commonly used method by farmer in order to prevent the crop vandalization by animals include building physical barriers, use of electric fences and manual surveillance and various such exhaustive and dangerous method.

## 2.2 REFERENCES:

[1] Mr.Pranav shitap, Mr.Jayesh redij, Mr.Shikhar Singh, Mr.Durvesh Zagade, Dr. Sharada Chougule. Department of ELECTRONICS AND TELECOMMUNICATION ENGINEERING, Finolex Academy of Management and technology, ratangiri , India.

[2] N.Penchalaiah, D.Pavithra, B.Bhargavi, D.P.Madhurai, K.Eliyas Shaik,S.Md.sohaib.Assitant Professor, Department of CSE,AITS, Rajampet,India UG Student, Department of CSE,AITS,Rajampet, India.

[3] Mr.P.Venkateswara Rao, Mr.Ch Shiva Krishna ,MR M Samba Siva Reddy LBRCE,LBRCE,LBRCE.

[4] Mohit Korche,Sarthak Tokse, Shubham Shirbhate, Vaibhav Thakre, S. P. Jolhe(HOD). Students , Final Year,Dept.of Electrical engineering,Government

College of engineering,Nagpur head of dept.,Electrical engineering,Government College of engineering,Nagpur.

## 2.3 PROBLEM STATEMENT DEFINITION STATEMENT:

In the world economy of many Country dependent upon the agriculture .In spite of economic development agriculture is the backbone of the economy. Crops in forms are many times ravaged by local animals like buffaloes, cows, goats, birds and fire etc. this leads to huge loss for the farmers.it is not possible for farmers to blockade to entire fields or stay 24 hours and guard it. Agriculture meets food requirements of the people and produces several raw materials for industries. But because of animal interference and fire in agricultural lands, there will be huge loss of crops. Crops will be totally getting destroyed.

# IDEATION AND PROPOSED SOLUTION

## 3.1 EMPATHY MAP CANVAS:


## 3.2 IDEATION AND BRAINSTORMING:


## 3.3 PROPOSED SOLUTION:

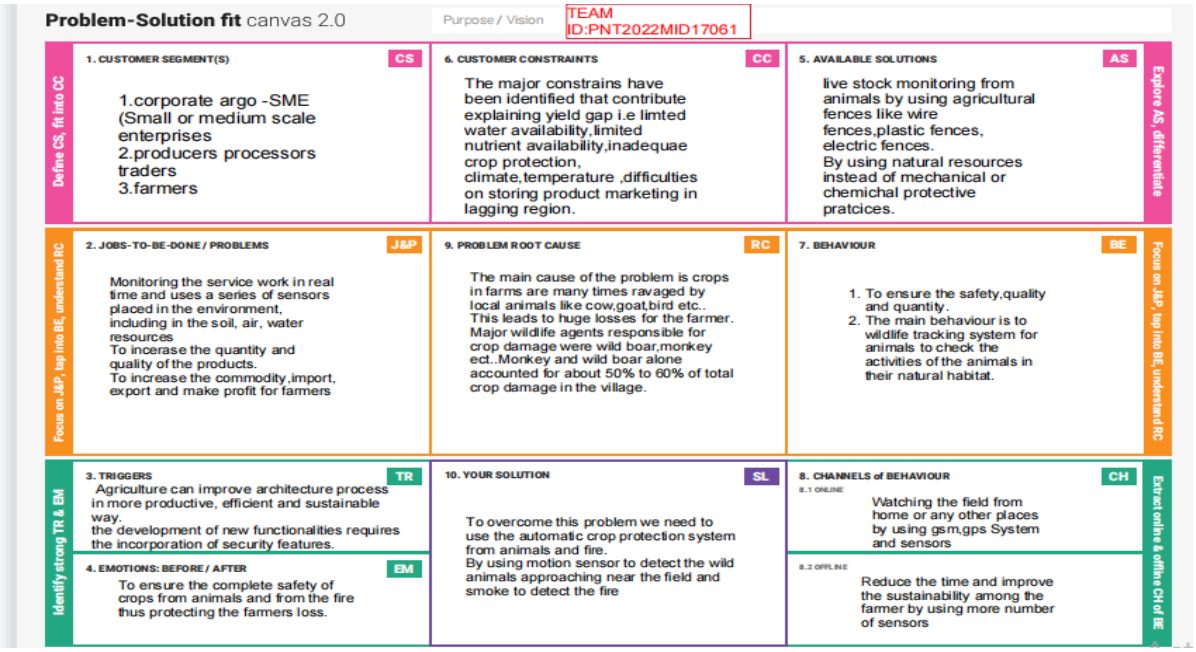
**PROPOSED SOLUTION TEMPLATE:**

Project team shall fill the following information in proposed solution template.

| S.No. | PARAMETER | DESCRIPTION |
|---|---|---|
| 1. | Problem statement(problem to be solved) | In the world economy of many Country dependent upon the agriculture .In spite of economic development agriculture is the backbone of the economy. Crops in forms are many times ravaged by local animals like buffaloes, cows, goats, birds and fire etc. this leads to huge loss for the farmers.it is not possible for farmers to blockade to entire fields or stay 24 hours and guard it. Agriculture meets food requirements of the people and produces several raw materials for industries. But because of animal interference and fire in agricultural lands, there will be huge loss of crops. Crops will be totally getting destroyed. |
| 2 | Idea/solution description | **Main solution:**<br>• Our main purpose of project is to develop intruder alert to the farm, to avoid losses due to animals and fire.<br>• Agricultural fences are quite an effective wild animal protection |

| | | |
|---|---|---|
| 3 | Novelty/uniqueness | • Helps farmers to better understand the important factor such as water , topography, aspect, vegetation and soil types.<br>• It also supports verification activities, by connecting information through the supply chain so that production claims can be checked<br>• Control of weeds and integrated management. |
| 4 | Social/impact | • Improve the productivity.<br>• Save lives of farmers.<br>• Increase the quality, by making maximum use of resources.<br>• Drones for farms by being able to cover hundreds of acres in one flight. |
| 5 | Business model(revenue model) | • Community based solution<br>• Increase the proper products cost.<br>• Canvas a business model. |
| 6 | Scalability of the solution | • The develop system will not harmful and injurious to animals as well as human beings.<br>• Low cost solution, lower dependency on power.<br>• Simple solution to suite the farmer community. |

## 3.4 PROBLEM SOLUTION FIT:



# REQUIREMENT ANALYSIS

## 4.1 FUNCTIONAL REQUIREMENT:

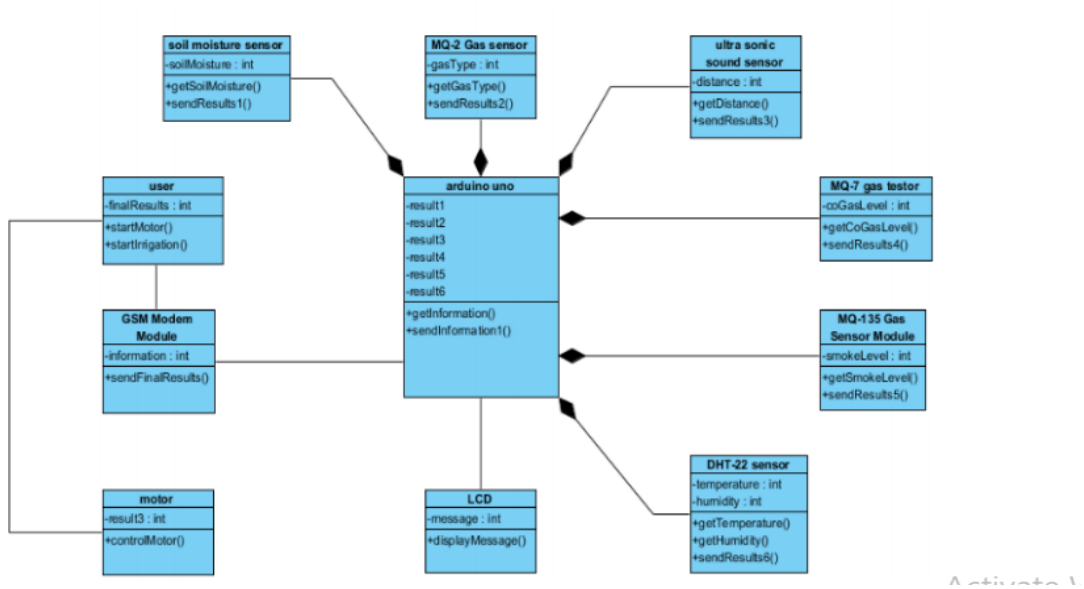
| FR-NO | FUNCTIONAL REQUIREMENTS | SUB-REQUIREMENTS |
|---|---|---|
| FR-1 | Fertilizing frame service | Documentation requirements and assisting information |
| FR-2 | Economical service | Assisting information |
| FR-3 | Technology assessment service | Selecting fertilizing features |
| FR-4 | Feature assessment service | Updated technical information and machinery selection |
| FR-5 | Information acquisition service | Assisting information about fertilizing rules |
| FR-6 | Farm and field customizing service | Potential data acquisition service |
| FR-7 | Field inspection | Spatial field information |
| FR-8 | Field observation service | Analyzed risks |
| FR-9 | Assisting remote controlling | Inspecting and controlling fertilizing task |
| FR-10 | Assisting "operational performance service" | Economical analysis of current technology |

## 4.2 NON FUNCTIONAL REQUIREMENT:

| NRF.NO | NON FUNCTIONAL REQUIREMENTS | DESCRIPTION |
|---|---|---|
| NRF-1 | Usability | To use new technologies and increase the quantity and quality |
| NRF-2 | Security | Protect the field from animals. |
| NRF-3 | Reliability | Increasing the demand for food with minimum resources |
| NRF-4 | Performance | Maintain good yield and provide sustainable quantity |
| NRF-5 | Availability | Agricultural fences are quite an effective wild animal protection |
| NRF-6 | Scalability | The develop system will not harmful and injurious to animals as well as human beings. |

# PROJECT DESIGN

## 5.1 DATA FLOW DIAGRAM:




## 5.2 SOLUTION AND TECHNICAL ARCHITECTURE:

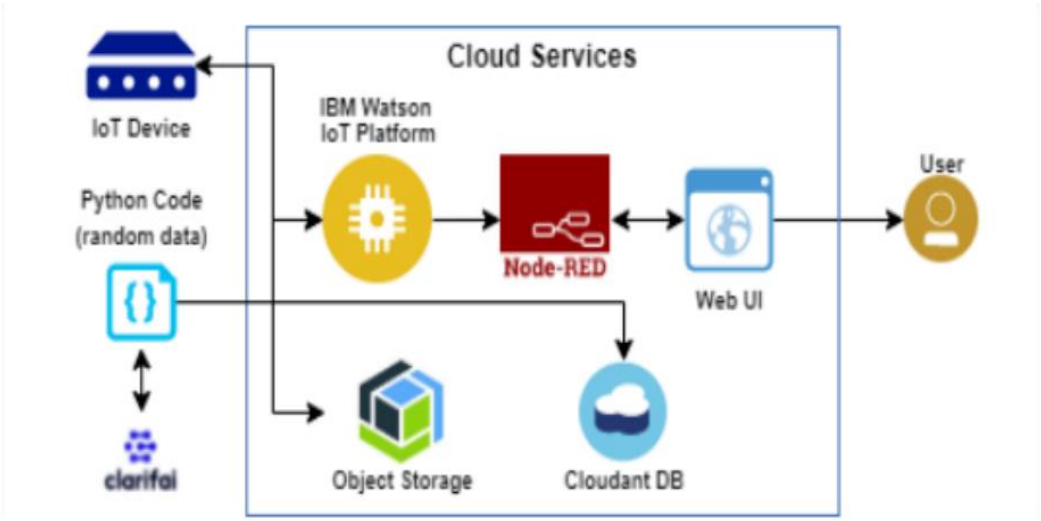


**TABLE-1:**

| sno | components | description | Technology |
|---|---|---|---|
| 1 | User interface | Interacts with iot device | Html,css,angular js etc.. |
| 2 | Application logic-1 | Logic for a process in the application | Python |
| 3 | Application logic-2 | Logic for process in the application | Clarifai |
| 4 | Application logic-3 | Logic for process in the application | IBM Waston Iot platform |
| 5 | Application logic-4 | logic for the process | Node red app service |
| 6 | User friendly | Easily manage the net screen appliance | Web uI |



## TABLE-2: APPLICATION AND CHARACTERISTICS

| sno | Characteristics | Description | Technology |
|---|---|---|---|
| 1 | Open source framework | Open source framework used | Python |
| 2 | Security implementations | Authentication using encryption | Encryptions |
| 3 | Scalable architecture | The scalability of architecture consists of 3 models | Web UI<br>Application server-python, clarifai<br>Database server-ibm cloud services. |
| 4 | Availability | It is increased by cloudant database | IBM cloud services |



## 5.3 USER STORIES:

| SPRINT | FUNCTIONAL REQUIREMENT | USER STORY NUMBER | USER STORY/TASK | STORY POINTS | PRIORITY | TEAM NUMBERS |
|---|---|---|---|---|---|---|
| Sprint-1 | | US-1 | Create the IBM Cloud services which are being used in this project. | 7 | high | **Pratheesha Sowmiya Vinisha Thulasimani** |
| Sprint-1 | | US-2 | Create the IBM Cloud services which are being used in this project. | 7 | high | Pratheesha Sowmiya Vinisha Thulasimani |
| Sprint-2 | | US-3 | IBM Watson IoT platform acts as the mediator to connect the web application to IoT devices, so create the IBM Watson IoT platform. | 5 | medium | Pratheesha Sowmiya Vinisha Thulasimani |
| Sprint-2 | | US-4 | In order to connect the IoT device to the IBM cloud, create a device in the IBM Watson IoT platform and get the device credentials | 6 | high | Pratheesha Sowmiya Vinisha Thulasimani |
| Sprint-3 | | US-1 | Configure the connection security and create API keys that are used in the Node-RED service for accessing the IBM IoT Platform. | 10 | high | Pratheesha Sowmiya Vinisha Thulasimani |
| Sprint-3 | | US-3 | Create a Node-RED service | 8 | high | Pratheesha Sowmiya Vinisha Thulasimani |
| Sprint-3 | | US-2 | Develop a python script to publish random | 6 | medium | Pratheesha Sowmiya |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | sensor data such as temperature, moisture, soil and humidity to the IBM IoT platform | | | Vinisha Thulasimani |
| **Sprint-3** | | US-1 | After developing python code, commands are received just print the statements which represent the control of the devices. | 8 | high | Pratheesha Sowmiya Vinisha Thulasimani |
| **Sprint-4** | | US-3 | Publish Data to The IBM Cloud | 5 | high | Pratheesha Sowmiya Vinisha Thulasimani |
| **Sprint-4** | | US-2 | Create Web UI in Node- Red | 8 | high | Pratheesha Sowmiya Vinisha Thulasimani |
| **Sprint-4** | | US-1 | Configure the Node-RED flow to receive data from the IBM IoT platform and also use Cloudant DB nodes to store the received sensor data in the cloudant DB | 6 | high | Pratheesha Sowmiya Vinisha Thulasimani |

# PROJECT PLANNING AND SCHEDULING

## 6.1 SPRINT PLANNING AND ESTIMATION:

| Sprint | Total Story Points | Duration | Sprint Start Date | Sprint End Date (Planned) | Story Points Completed (as on Planned End Date) | Sprint Release Date (Actual) |
|---|---|---|---|---|---|---|
| Sprint-1 | 20 | 6days | 24 Oct 2022 | 29 Oct 2022 | 20 | 29 Oct 2022 |
| Sprint-2 | 20 | 6days | 31 Oct 2022 | 05 Nov 2022 | 20 | 05 Nov 2022 |
| Sprint-3 | 20 | 6days | 07 Nov 2022 | 12 Nov 2022 | 20 | 12 Nov 2022 |
| Sprint-4 | 20 | 6days | 14 Nov 2022 | 19 Nov 2022 | 20 | 19 Nov 2022 |

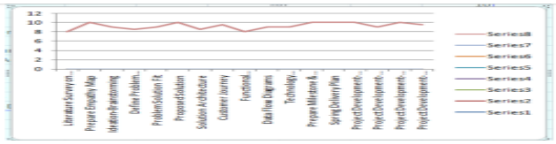
**Velocity:**

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

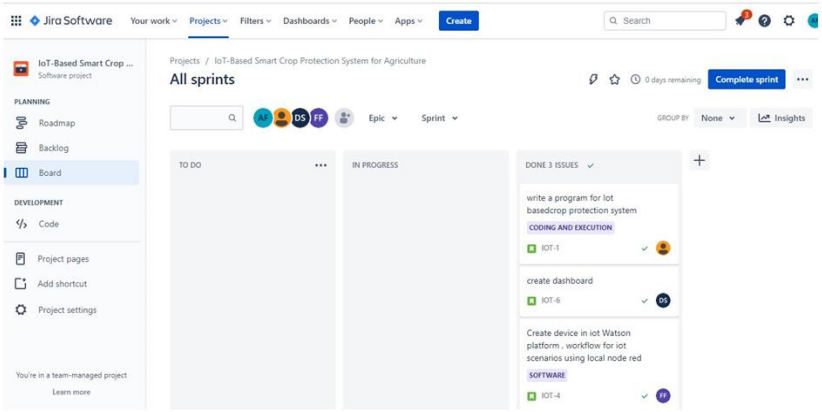
***AV=Sprint duration/velocity=20/10***

**Burndown Chart:**

A burndown chart is a graphical representation of work left to do versus time However, burndown charts can be applied to any project containing measurable progress overtime.



# 6.2 REPORTS FROM JIRA SOFTWARE

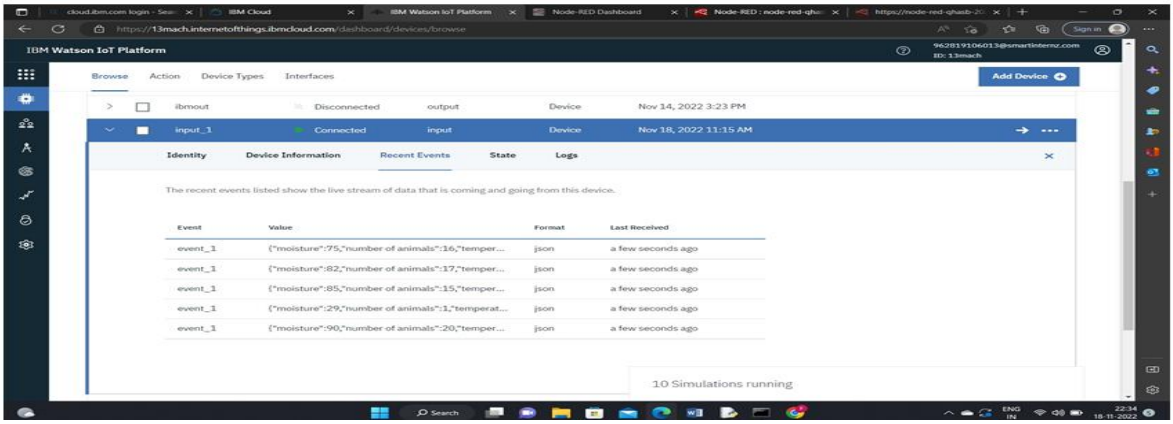



# ROAD MAP


# CODING AND SOLUTIONING

## 7.1 FEATURE-1

```
File  Edit  Format  Run  Options  Window  Help

temp_data = { 'Temperature' : temp_sensor }
camera_data = { 'Animal attack' : camera_reading}
moist_data = { 'Moisture Level' : moist_level}
water_data = { 'Water Level' : water_level}


# publishing Sensor data to IBM Watson for every 5-10 seconds.

success = deviceCli.publishEvent("Temperature sensor", "json", temp_data, qos=0)
sleep(1)
if success:
  print("...............................publish ok.................................")
  print("Published Temperature = %s C"% temp_sensor,"to IBM Watson")

success = deviceCli.publishEvent("camera", "json", camera_data, qos=0)
sleep(1)
if success:
  print("Published Animal attack is %s "%camera_reading ,"to IBM Watson")

success = deviceCli.publishEvent("Moisture sensor", "json", moist_data,qos=0)
sleep(1)
if success:
  print("Published Moisture level is %s "% moist_level ,"to IBM Watson")

success = deviceCli.publishEvent("water sensor", "json", water_data, qos=0)
sleep(1)
if success:
  print("Published Water level is %s "% water_level,"to IBM Watson")


#To send alert message to farmer that animal attack on crops.

if (camera_reading == "Detected"):
 success = deviceCli.publishEvent("Alert3", "json", { 'alert3' : "Animal attack on crops detected" }, qos=0)
sleep(1)
if success:
   print('Published alert3 : ' , "Animal attack on crops detected","to IBM Watson","to IBM Watson")
print("")
#To send alert message if Moisture level is LOW and to Turn ON Motor-1 for irrigation.
```




# ARDIUNO AT Mega328P

ATmega328 is a single chip microcontroller created by Atmel in the mega AVR family. The Atmel 8-bit AVR RISC based microcontroller combines 32 kB ISP flash memory with read-while-write capabilities, 1 kB EEPROM, 2 kB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz.

# SMOKE SENSOR (MQ-2)

A smoke sensor is a device that senses smoke, typically as an indicator of fire. Commercial and residential security devices issue a signal to a fire alarm control panel as part of a fire alarm system,

while household detectors, known as smoke alarms, generally issue a local audible or visual alarm from the detector itself. The Analog Smoke/LPG/CO Gas Sensor (MQ2) module utilizes an MQ-2 as the sensitive component and has a protection resistor and an adjustable resistor on board. The MQ-2 gas sensor is sensitive to LPG, i-butane, propane, methane, alcohol, Hydrogen and smoke. It could be used in gas leakage detecting equipment's in family and industry. The resistance of the sensitive component changes as the concentration of the target gas changes. Sensitive material of MQ-2 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exist, the sensors conductivity is higher along with the gas concentration rising. Please use simple electronic circuit, Convert change of conductivity to correspond output signal of gas concentration.

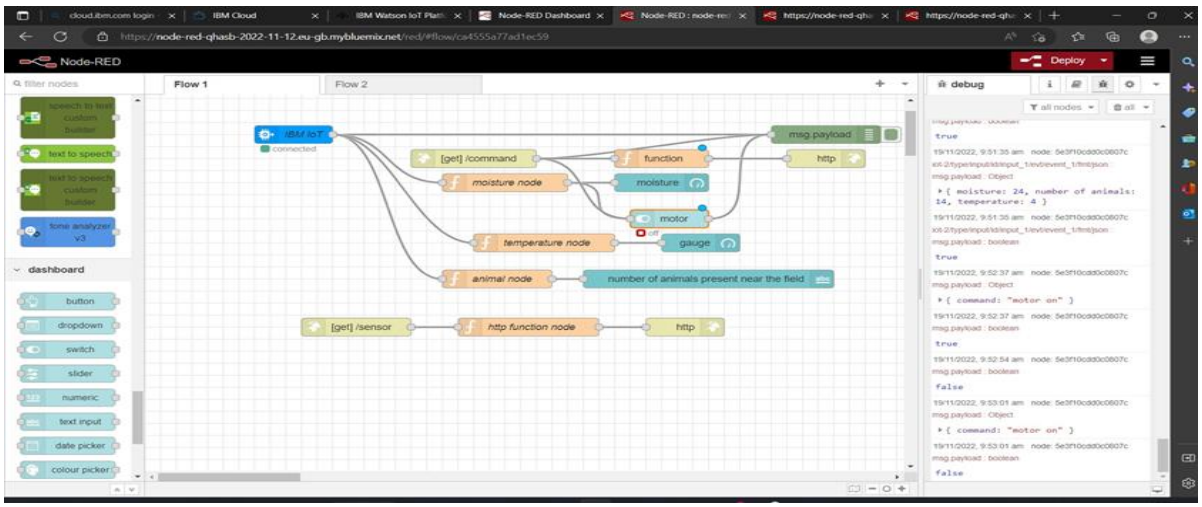
# GSM Module

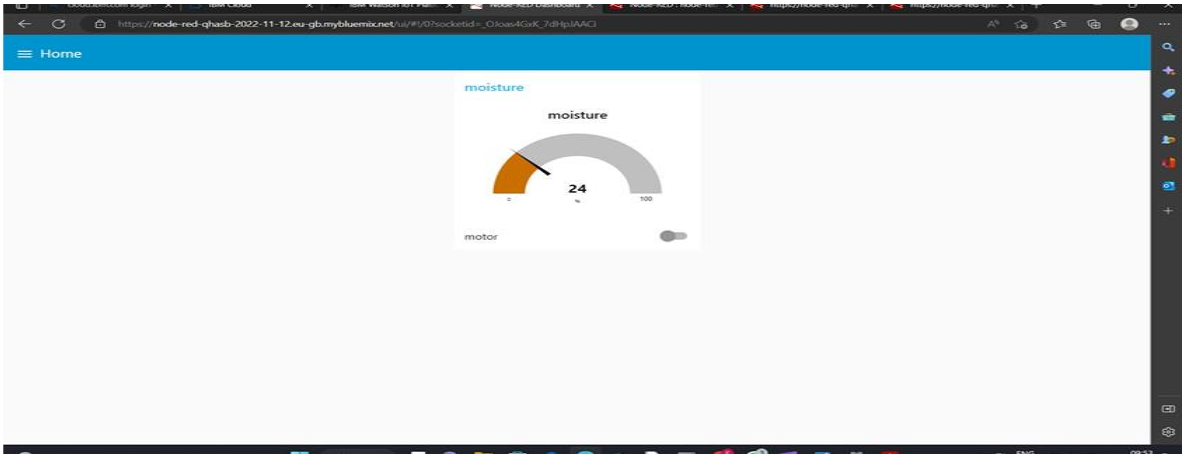
SIM800 is a quad-band GSM/GPRS module designed for the global market. It work on frequencies GSM 850MHz, EGSM 900MHz, DCS 1800MHz and PCS 1900MHz.SIM800 features GPRS multi-slot class 12/ class 10 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.SIM800 has 68 SMT pads, and provides all hardware interfaces between the module and customers' boards.SIM800 integrates TCP/IP protocol and extended TCP/IP AT commands which are very useful for data transfer applications.

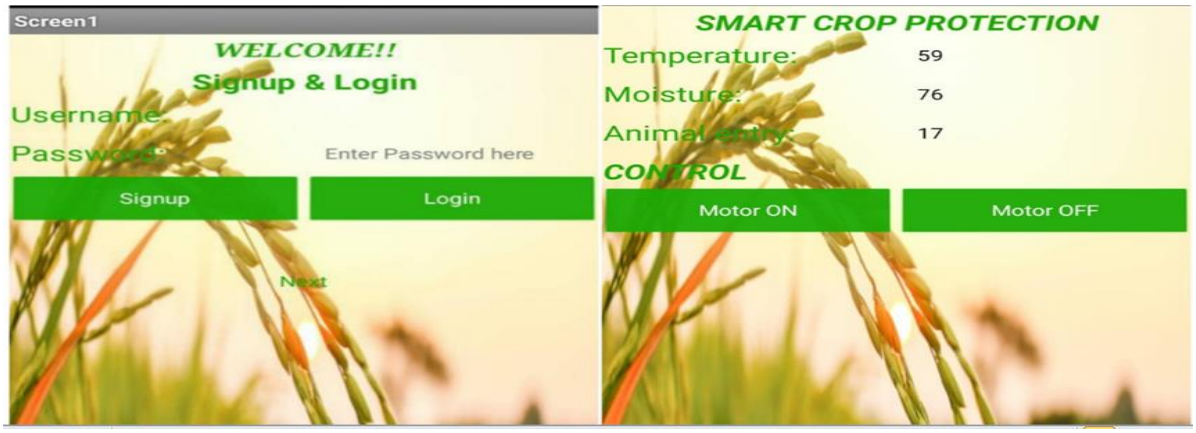
# PASSIVE INFRARED SENSOR (PIR)

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. PIRs are basically made of a pyroelectric sensor, which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low.

## Features 7.2






Output: Digital pulse high (3V) when triggered (motion detected) digital low when idle (no motion detected). Pulse lengths are determined by resistors and capacitors on the PCB and differ from sensor to sensor. Power supply: 5V-12V input voltage for most modules (they have a 3.3V regulator), but 5V is ideal in case the regulator has different specs.

**BUZZER**

Specifications

- Rated Voltage : 6V DC
- Operating Voltage : 4 to 8V DC
- Rated Current* : ≤30mA
- Sound Output at 10cm* : ≥85dB
- Resonant Frequency : 2300 ±300Hz
- Tone : Continuous A buzzer is a loud noise maker.

Most modern ones are civil defense or air- raid sirens, tornado sirens, or the sirens on emergency service vehicles such as ambulances, police cars and fire trucks. There are two general types, pneumatic and electronic.

# DC MOTOR

Motor is a device that creates motion, not an engine; it usually refers to either an electrical motor or an internal combustion engine. In most common DC motors (and all that BEAMers will see), the external magnetic field is produced by high-strength permanent magnets. The stator is the stationary part of the motor - this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor (together with the axle and attached commutator) rotate with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator. The above diagram shows a common motor layout -- with the rotor inside the stator (field) magnets.

# LIQUID CRYSTAL DISPLAY

Liquid crystal display is a type of display which used in digital watches and many portable computers. LCD displays utilize two sheets of polarizing material with a liquid crystal solution between them. An electric current passed through the liquid causes the crystals to align so that light cannot pass through them. Each crystal, therefore, is like a shutter, either allowing light to pass through or blocking the light. The liquid crystals can be manipulated through an applied electric voltage so that light is allowed to pass or is blocked. By carefully controlling where and what wavelength (color) of light is allowed to pass, the LCD monitor is able to display images. A back light provides LCD monitor's brightness. Other advances have allowed LCD's to greatly reduce liquid crystal cell response times. Response time is basically the amount of time it takes for a pixel to "change colors".

# TESTING

# 8.1

**Acceptance Testing**

### 1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [Product Name] project at the time of the release to User Acceptance Testing (UAT).

### 2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

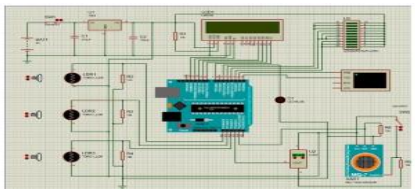
| Resolution | Severity 1 | Severity 2 | Severity 3 | Severity 4 | Subtotal |
|---|---|---|---|---|---|
| By Design | 10 | 4 | 2 | 3 | 20 |
| Duplicate | 1 | 0 | 3 | 0 | 4 |
| External | 2 | 3 | 0 | 1 | 6 |
| Fixed | 11 | 2 | 4 | 20 | 37 |
| Not Reproduced | 0 | 0 | 1 | 0 | 1 |
| Skipped | 0 | 0 | 1 | 1 | 2 |
| Won't Fix | 0 | 5 | 2 | 1 | 8 |
| Totals | 24 | 14 | 13 | 26 | 77 |

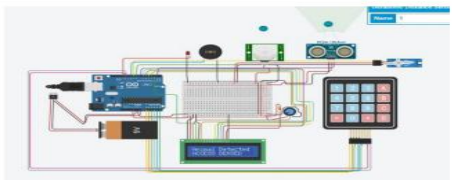
### 3. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

| Section | Total Cases | Not Tested | Fail | Pass |
|---|---|---|---|---|
| Print Engine | 7 | 0 | 1 | 6 |
| Client Application | 51 | 0 | 2 | 49 |
| Security | 2 | 0 | 0 | 2 |
| Outsource Shipping | 3 | 0 | 0 | 3 |
| Exception Reporting | 9 | 0 | 2 | 7 |
| Final Report Output | 4 | 0 | 1 | 3 |
| Version Control | 2 | 0 | 0 | 2 |

## Simulation:





# 9. RESULTS

## 9.1 performance Metrics:

| Project Name | Scope/feature | Functional Changes | Hardware Changes | Software Changes | Impact of Downtime | Load/Voluem Changes | Risk Score | Justification |
|---|---|---|---|---|---|---|---|---|
| IoT based smart crop protection | New | Low | No Changes | Moderate | | >5 to 10% | ORANGE | As we have seen the changes |
| | sensing | | | | | | | As we have seen the changes |
| | displaying | customizable | | | | | | As we have seen the changes |
| | registration | | | | | | | As we have seen the changes |
| | availability | | | | | | red | As we have seen the changes |

| NFT - Detailed Test Plan | | | |
|---|---|---|---|
| S.No | Project Overview | NFT Test approach | Assumptions/Dependencies/Risks |
| 1 | IoT based smart crop protection | testing | Assumptions |

| End Of Test Report | | | | | | | |
|---|---|---|---|---|---|---|---|
| Project Overview | NFT Test approach | NFR - Met | Test Outcome | GO/NO-GO decision | Recommendations | Identified Defects (Detected/Closed/Open) | Approvals/SignOff |
| IoT based crop protection | testing | sensing-met | dashboard | go decision | | network issuews | |
| | | registration-met | mail | go decision | | connection failure | |
| | | display-met | application/link | go decision | | | |

. The problem of crop vandalization by wild animals and fire has become a major social problem in current time. It requires urgent attention as no effective solution exists till date for this problem. Thus this project carries a great social relevance as it aims to address this problem. This project will help farmers in protecting their orchards and fields and save

them from significant financial losses and will save them from the unproductive efforts that they endure for the protection their fields. This will also help them in achieving better crop yields thus leading to their economic wellbeing.

# ADVANTAGES AND DISADVANTAGES

## Advantage:

Controllable food supply. you might have droughts or floods, but if you are growing the crops and breeding them to be hardier, you have a better chance of not straving. It allows farmers to maximize yields using minimum resources such as water, fertilizers.

### Disadvantage:

The main disadvantage is the time it can take to process the information.in order to keep feeding people as the population grows you have to radically change the environment of the planet.

## 11.CONCLUSION:

Farmers encounter severe threats in rural parts of India. Hence,to overcome this issue we have designed this system. Therefore the designed system is affordable and useful to the farmers. The designed system won't be harmful to animals and person ,and it protects the farmareas.IoT can positively impact a lot of areas and industries. This also makes IoT solutions veryeffective in helping the environment and improving sustainability. IoT's nature of data collecting,optimizing, and automating, impacts the environment positively and it is expected that it will be even better in the future.These Iot based systems help companies speed up work, cut down costs, and identify growth opportunities.

## 12 APPENDIX:

**user interface: https://node-red-qhasb-2022-11-12.eu-gb.mybluemix.net/ui/#!/0?socketid=-b7QvINYF1mJxnQ8AACu**

# FUTURE SCOPE

In the future, there will be very large scope, this project can be made based on Image processing in which wild animal and fire can be detected by cameras and if it comes towards farm then system will be directly activated through wireless networks. Wild animals can also be detected by using wireless networks such as laser wireless sensors and by sensing this laser or sensor’s security system will be activated.