PROJECTREPORT

**Project Name**: SMARTFARMER- IOT ENABLED SMART FARMINGAPPLICATION

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1. INTRODUCTION
   1. ProjectOverview

IoT-based agriculture system helps the farmer in monitoring different parameters of his fieldlike soil moisture, Temperature, humidity using some sensors. Farmers can monitor all the sensorparameters by using a web or mobile application even if the farmer is not near his field. Wateringthe crop is one of the important tasks for the farmers. They can make the decision whether towater the crop or postpone it by monitoring the sensor parameters and controlling the motorpumpsfrom themobile applicationitself.



* 1. PURPOSE

The smart agriculture model main aim **to avoid water wastage in the irrigation process**. It islow cost andefficient system Isshown below.It includes NodeMCU,Arduino Nano,sensorslikesoil moistureand Dht11,solenoid valves, relays.

2.2Existingproblem

1. LITERATURESURVEY

Thechallengesofa [smartagriculturesystem](https://www.techtarget.com/iotagenda/post/IoT-brings-resource-gains-sustainability-to-agriculture)includetheintegrationofthesesensorsandtyingthesensordatatotheanalyticsdrivingautomationandresponseactivities.Whenintegrated,the [use of data analytics](https://internetofthingsagenda.techtarget.com/blog/IoT-Agenda/How-IoT-can-provide-greater-value-to-the-agriculture-industry)can reduce the overallcost of agriculture andcontribute to higherproduction from the same amount of area through precise control of water, fertilizer and light.Smartmethodsallowforfarmingonsmallerandmoredistributedlandsthroughremotemonitoring,whetherindoor oroutdoor.

Tosuccessfullydeployasmartagriculturesystem,considersettingupacommunicationsnetwork that can integrate a limited number of sensors across a large area of farmland. This willrequire third-party network provisioning or setting up a private network consisting of accesspointsanduplinkstoaprivatebackhaulnetwork,whichchannelsallthedatatraffictocentralizedmonitoring softwareor an analytics head-end system

* Itisnotasecuresystem.
* Thereisnomotiondetectionforprotectionofagriculturefield.
* Automationisnotavailable.
  1. References

1. YemeserachMekonnen,LamarBurton,ArifSarwat,ShekharBhansaliDepartmentofElectricalandComputerEngineering,FloridaInternationalUniversity,

Miami,Email:{ymeko001,lburt004,asarwat,Sbhansa}@ﬁu.edu

1. ANIOTBASEDSMARTAGRICULTURESYSTEM

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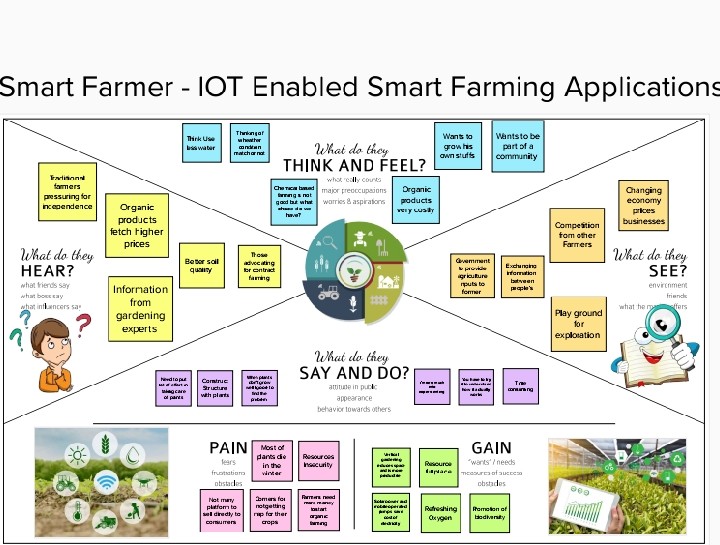
‡Inst.ofElectronics,ComputerandTelecommunicationEngineering(IEIIT),CNRItaly

§Inst.ofAgriculturalMechanization,Earth-MovingMachineryandOff-RoadVehicles(IMAMOTER),CNRItaly

1. Nikesh Gondchawar and R. S. Kawitkar, "IoTbasedSmartAgriculture",InternationalJournalofAdvancedResearchinComputerandCommunication Engineering, vol. 5, no. 6, pp.2278-1021,June2016
   1. ProblemStatementDefinition

Thesoilmoisturesensormeasureswetnesscontentinthesoil.TheArduinoUNOmicrocontrollerusedtoreceiveinputfromavarioussensorsanditcanbecontrolledautomatically. When soil moisture sensor goes low the water pump will be on and it exceedsdefined levels of the water motor will turn off automatically. We can constantly monitor thegrowth of a crop using ultrasonic sensor. PIR sensor detects the motion or unusual movement intheagriculturalland.Thisdevicehisveryhelpfultotheformertomonitorandcontrolenvironmental parameters at their field. The farmers did not go to theirfield, they can remotelymonitorand control using cloud.

1. IDEATION&PROPOSEDSOLUTION
   1. EmpathyMapCanvas



* 1. IdeationandBrainstorming

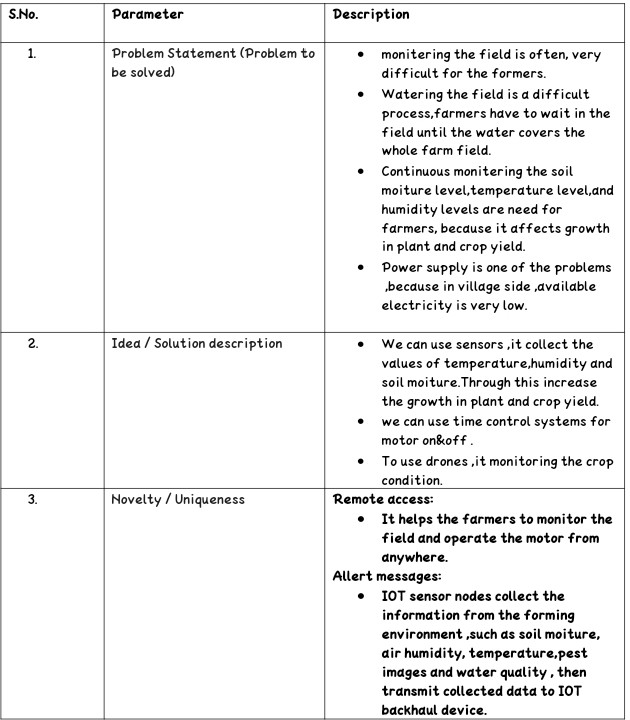
Introduction on Internet of Things (IoT), application of IoT in agricultural field to improvethe yield and quality by reducing the cost is provided. The sensors which are used in thearchitecture are discussed briefly and the process of transmission of data from the agriculturefield to the central system is explained. The proposed system advantages are included. Inaddition,openresearchissues,challenges,andfutureofIoTinagriculturalfieldarehighlighted. The concept is basically developed on an idea, where there are numerous thingsor objects - such as Arduino, sensors, GSM models, LCD display, etc., that are connectedwith the Internet. Each of the objects has a different address and is able to interact with otheritems.The things orobjects co-operate witheachothertoreach acommongoal.

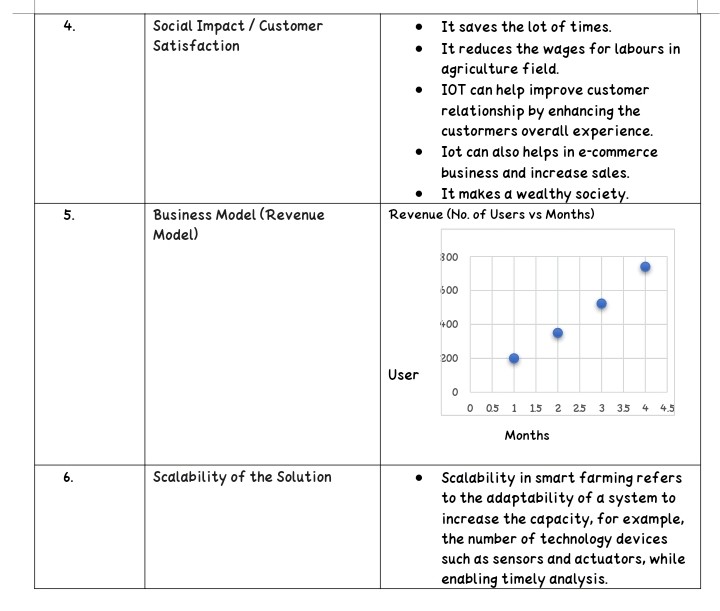
We are going to construct a smart agricultural monitoring system which can collect crucialagricultural data and send it to an IoT platform called Thingspeak in real time where the datacan be logged and analyzed. The logged data on Thingspeak is in graphical format, a botanistor a reasonably knowledged farmer can analyze the data (from anywhere in the world) tomakesensiblechanges inthe suppliedresources (to crops)to obtain highquality yield.

Smart agriculture monitoring system or simply smart farming is an emerging technologyconcept where data from several agricultural fields ranging from small to large scale and itssurrounding are collected using smart electronic sensors. The collected data are analyzed byexperts and local farmers to draw short term and long-term conclusion on weather pattern,soil fertility, current quality of crops, amount of water that will be required for next week to amonth etc.

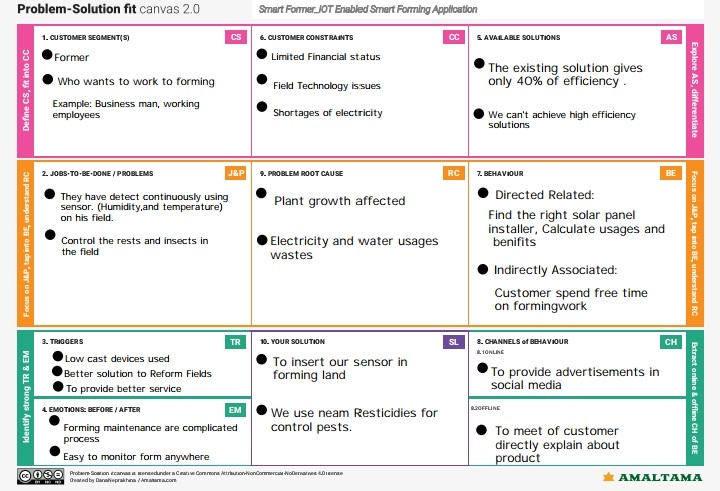
Wecantakesmartfarmingastepfurtherbyautomatingseveralparts offarming, forexample smart irrigation and water management. We can apply predictive algorithms onmicrocontrollers or SoC to calculate the amount of water that will be required today for aparticular agriculture field. Say, if there was rain yesterday and the quantity of water requiredtoday is going to be less. Similarly, if humidity was high the evaporation of water at upperground level is going to be less, so water required will be less than normal, thus reducingwaterusage.

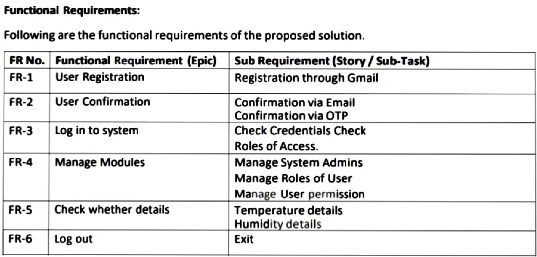
* 1. ProposedSolution





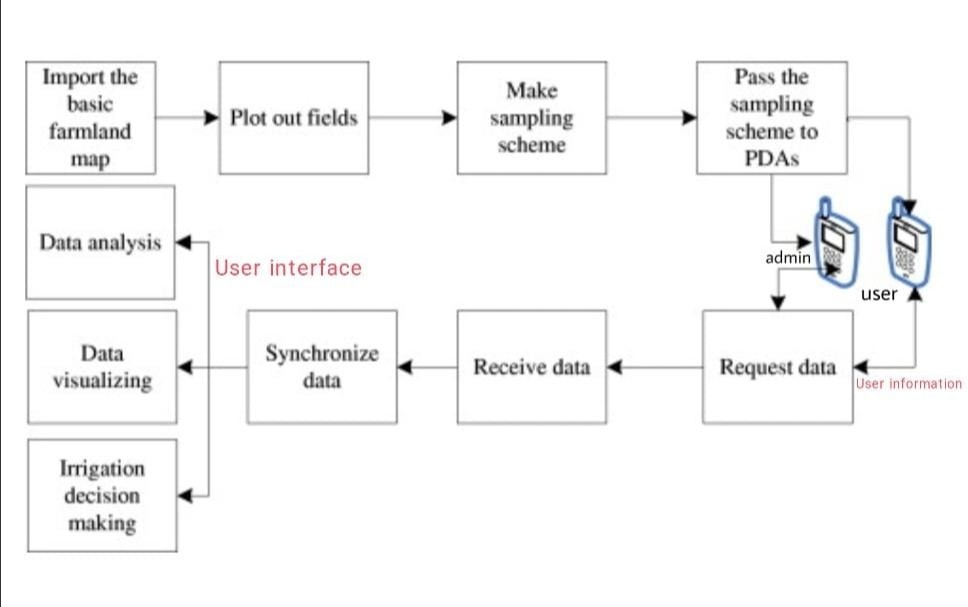
* 1. Problemsolutionfit



1. RequirementAnalysis
   1. FunctionalRequirement
2. PRODUCTDESIGN
   1. Dataflowdiagrams

A Data Flow Diagram (DFD) is a traditional visual representation of the information flowswithin a system. A neat and clear DFD can depict the right amount of the system requirementgraphically. It shows how data enters and leaves the system, what changes the information,andwheredata is stored.

* + - The different soil parameters temperature, soil moistures and then humidity are sensedusingdifferent sensors and obtained valueis stored in theIBMcloud.
    - Arduino UNO is used as a processing Unit that process the data obtained from the sensorsandwhetherdata from the weather API.
    - NODE-RED is used as a programming tool to write the hardware, software, and APIs. TheMQTTprotocol is followed forthecommunication.
    - All the collected data are provided to the user through a mobile application that wasdeveloped using the MIT app inventor. The user could plan through an app, weather to waterthe crop or not depending upon the sensor values. By using the app they can remotely operatetothemotor switch.

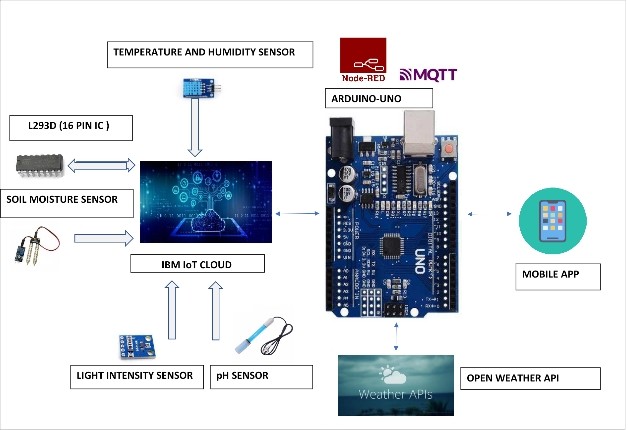


* 1. SolutionandTechnicalArchitecture

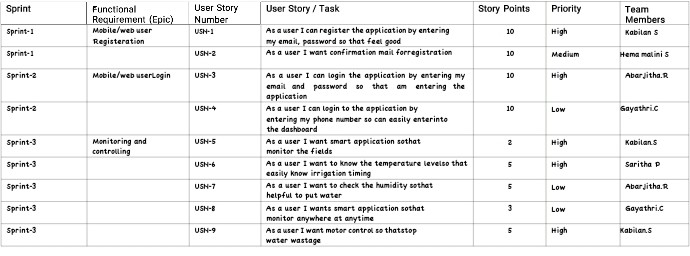
TheDeliverableshallincludethearchitecturaldiagramasbelowandtheinformationasperthe table1& table2 Guidelines:

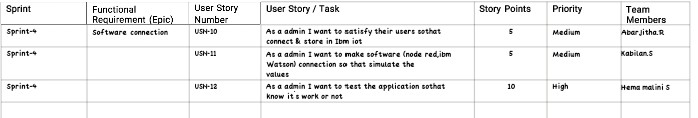
* + - Thedifferentsoilparameterstemperature,soilmoisturesandthenhumidityaresensedusingdifferent sensors and obtained valueis stored in theIBMcloud.
* ArduinoUNOisusedasaprocessingUnitthatprocessthedataobtainedfromthesensorsandwhetherdata from the weather API.
* NODE-REDisusedasaprogrammingtooltowritethehardware,software,andAPIs.TheMQTTprotocol is followed forthecommunication.
* AllthecollecteddataareprovidedtotheuserthroughamobileapplicationthatwasdevelopedusingtheMITappinventor.Theusercoulddecidethroughanapp,weatherto

waterthecropornotdependinguponthesensorvalues.Byusingtheapp,theycanremotelyoperatethemotor switch.



1. **PROJECTPLANNINGANDSCHEDULING**





1. **CODINGANDSOLUTIONING**
   1. **Feature**

importtimeimportsys

importibmiotf.applicationimportibmiotf.deviceimportrandom

#Provideyour IBMWatsonDeviceCredentialsorganization="hde0t6"

deviceType = "galaxy"deviceId="98765"authMethod="token"authToken="987654321"

#InitializeGPIO

defmyCommandCallback(cmd):

print("Command received:%s"%cmd.data['command'])status=cmd.data['command']

ifstatus=="lighton":

print("ledison")elifstatus=="lightoff":

print ("led is off")else:

print("pleasesendpropercommand")

try:

deviceOptions={"org":organization,"type":deviceType,"id":deviceId,"auth-method":authMethod,"auth-token":authToken}

deviceCli=ibmiotf.device.Client(deviceOptions)

#..............................................

except Exceptionase:

print("Caughtexception connecting device:%s"%str(e))

sys.exit()

# Connectandsenda datapoint"hello"with value"world" intothecloudasaneventoftype"greeting"10times

deviceCli.connect()

whileTrue:

#GetSensorDatafromDHT11

temp=random.randint(90,110)Humid=random.randint(60,100)

data={'temp':temp,'Humid':Humid}#printdata

defmyOnPublishCallback():

print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % Humid, "toIBMWatson")

success=deviceCli.publishEvent("IoTSensor","json",data,qos=0,on\_publish=myOnPublishCallback)

if notsuccess:

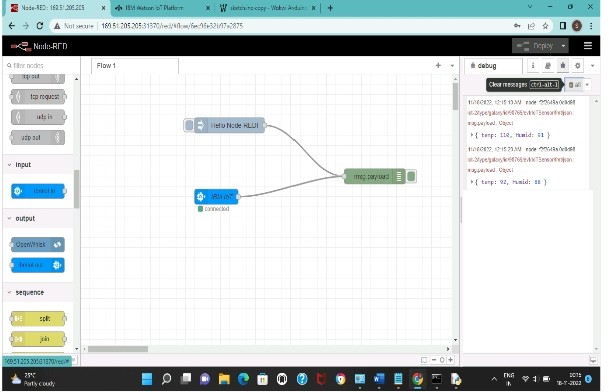
print("Not connected to IoTF")time.sleep(10)

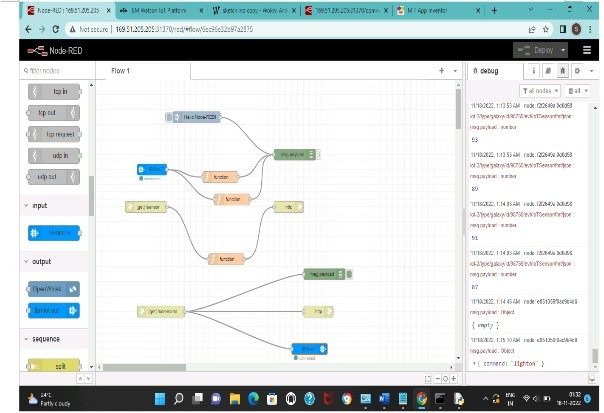
deviceCli.commandCallback=myCommandCallback

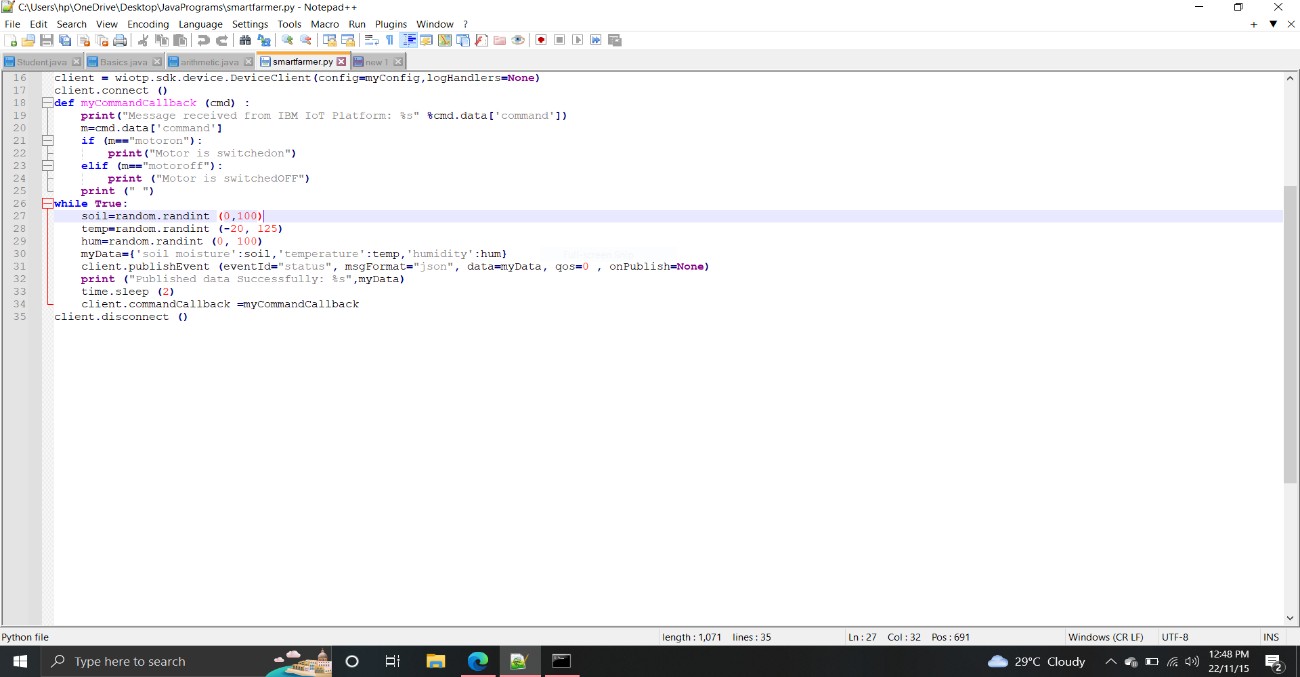
#Disconnect thedeviceandapplicationfromtheclouddeviceCli.disconnect()

1. **TESTING**
   1. **Testcase**

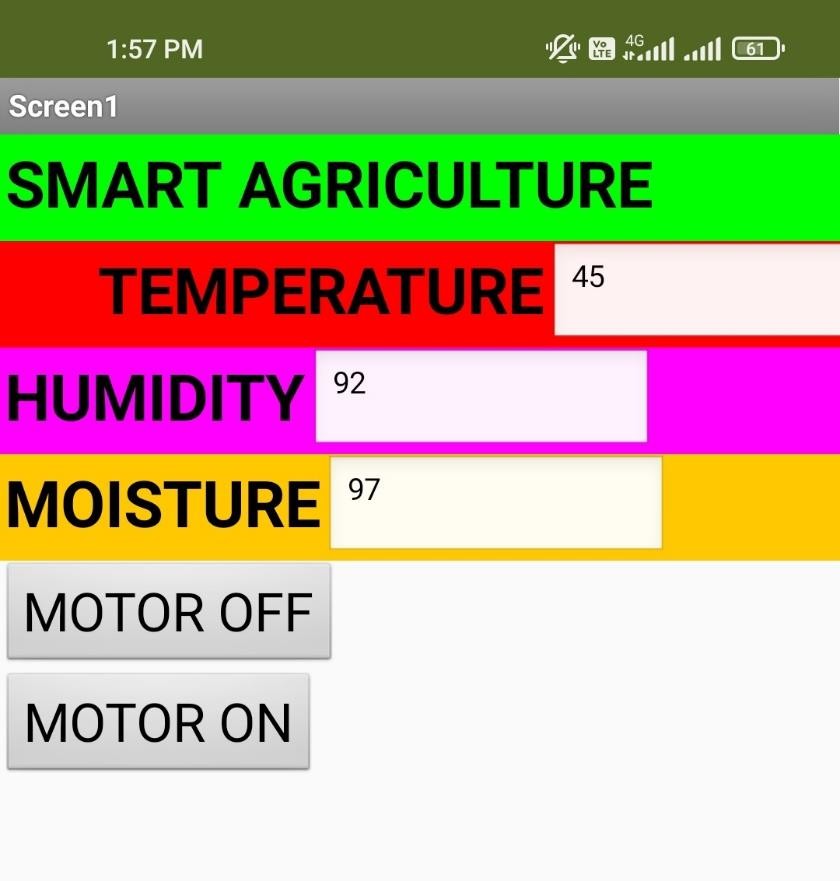
WebapplicationusingNodeRed



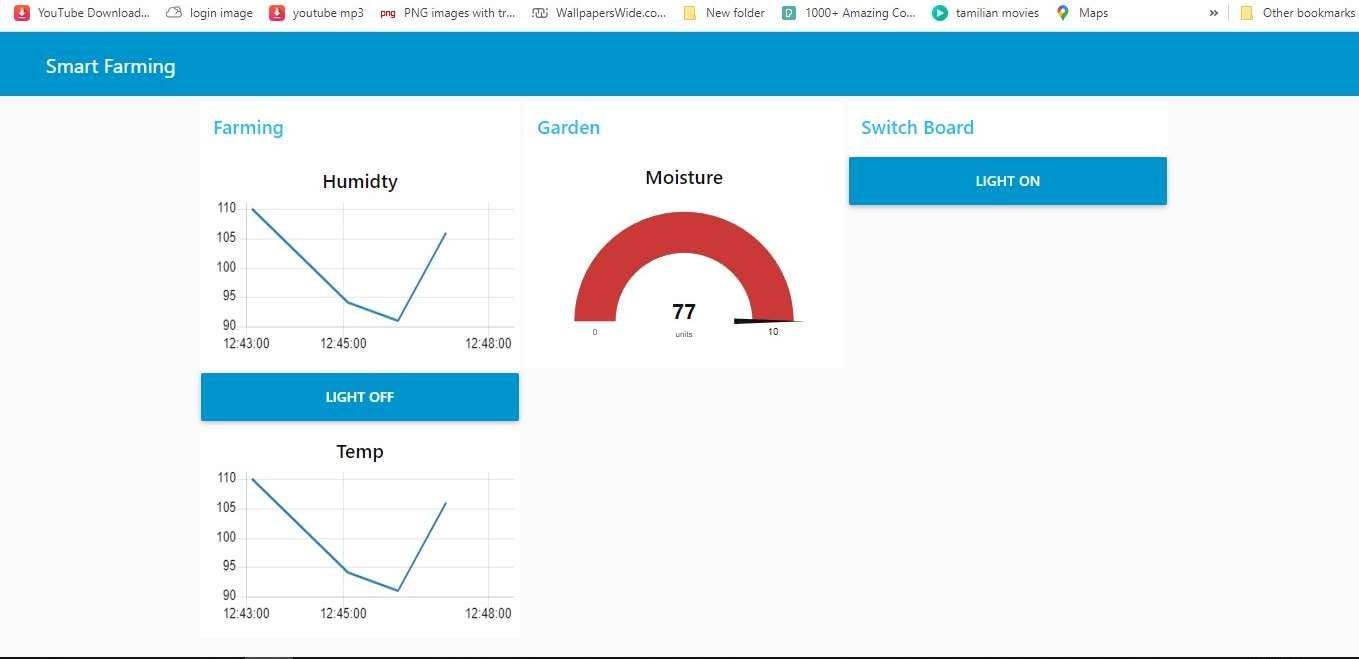




* 1. **UserAcceptanceTesting**



1. **RESULTS**
   1. **PerformanceMetrics**



1. Advantagesanddisadvantages

**Advantages:**

* Aremotecontrolsystemcanhelpinworkingirrigationsystemvalvesdependentonschedule. Irrigating remote farm properties can be exceptionally troublesome and labor-intensive.It gets hard to comprehend when the valves were started and whether the idealmeasureofwater was distributed.
* For situationswhereaquick reactionisrequired,manualvalve actuationmay notbeconceivableconstantly.Thus,remoteobservingandcontrolofirrigationsystems,generators or wind machines or some other motor-driven hardware become the next logicalstep.
* Various solutions are available to monitor engine statistics and starting or stopping theengine. When the client chooses to begin or stop the motor, the program transmits a sign totheunit within seconds by means of amobile phonesystem.
* Submersible weight sensors or ultrasonicsensors canscreen thedegree of tanks,lakes,wells and different kinds of fluid stockpiling like fuel and compost.The product figuresvolumedependentonthetankorlakegeometryaftersometime.Itconveysalarmsdependent on various conditions.

Disadvantages:

* The smart agriculture needs availability of internet continuously. Rural part of most of thedevelopingcountriesdonotfulfilthisrequirement. Moreoverinternetconnectionisslower.
* The smart farming based equipment require farmers to understand and learn the use oftechnology.Thisismajorchallengeinadoptingsmart agriculturefarmingatlargescaleacrossthe countries.

1. CONCLUSION

Farmers can benefit greatly from an IoT-basedsmart agriculture system. As a result ofthe lack of irrigation, agriculture suffers. Climate factors such as humidity, temperature,andmoisturecanbeadjusteddependentonthelocalenvironmentalvariables.Thistechnology also detects animal invasions, which are a major cause of crop loss. Thistechnology aids in the scheduling of irrigation based on present data from the field andrecords from a climate source. It helps in deciding the farmer to whether to do irrigationor not to do. Continuous internet connectivity is required for continuous monitoring ofdata from sensors. This also can be overcome by using GSM unit as an alternative ofmobileapp. By GSM, SMScan besent to farmers phone.

1. Futurescope

In the current project we have implemented the project that can protect and maintain thethe crop. In this project the farmer monitor and control the field remotely. In future wecanadd orupdate few morethings to this project

. • We can create few more models of the same project ,so that the farmer can haveinformationof aentire.

* + We can update the this project by using solar power mechanism. So that the powersupply from electric poles can be replaced with solar panels. It reduces the power linecost.Itwillbeaonetimeinvestment.Wecanaddsolarfencingtechnologytothisproject.
  + We can use GSM technology to this project so that the farmers can get the informationdirectly to his home through SMS. This helps the farmer to get information if there is ainternetissues.
  + We can add camera feature so that the farmer can monitor his field in real time. Thishelpsin avoiding thefts.

1. Appendix

**SourceCode**

import wiotp.sdk.deviceimport time

import osimport datetimeimport randommyConfig={

"identity":{

"orgId":"0hzydu",

"typeId":"NodeMCU","deviceId":"12345"

},

"auth":{

"token":"12345678"

}

}

client=wiotp.sdk.device.DeviceClient(config=myConfig,logHandlers=None)client.connect()

defmyCommandCallback(cmd):

print("MessagereceivedfromIBMIoTPlatform:%s"%cmd.data['command'])m=cmd.data['command']

if (m=="motoron"):print("Motorisswitchedon")

elif(m=="motoroff"):

print("MotorisswitchedOFF")print (" ")

whileTrue:

moist=random.randint(0,100)

temp=random.randint(-20,125)

hum=random.randint(0,100)

myData={'moisture':moist,'temperature':temp,'humidity':hum}client.publishEvent(eventId="status",msgFormat="json",data=myData,qos=0,

onPublish=None)

print("PublisheddataSuccessfully:%s",myData)time.sleep(2)

client.commandCallback=myCommandCallbackclient.disconnect()

**Github link:https://github.com/IBM-EPBL/IBM-Project-5909-1658819746**

**Pr**[**ojectdemolink:**](https://drive.google.com/file/d/1JrQNUaB8oe5yvimCqPT_rt1WQa1XwOpM/view?usp=drivesdk)

[**https://drive.google.com/file/d/1JrQNUaB8oe5yvi**](https://drive.google.com/file/d/1JrQNUaB8oe5yvimCqPT_rt1WQa1XwOpM/view?usp=drivesdk)**mCqPT**

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