Project Name : SMART AGRICULTURAL SYSTEM USING IOT (INTERNET OF THINGS)

Team Name : **BOOTSTRAP PARADOX**

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ABSTRACT

Successful transformation of agriculture in to a modern industry and remarkable increase in factor productivity have contributed to improvement in human wellbeing . The availability of huge power unit and related electro-mechanical systems for land preparations , cultivation , crop and livestock protection enabled human to expand cultivated areas , converts otherwise marginal lands into productive units , and free of surplus farm labour to engage in nonfarm service sectors that are equally rewarding . Despite the tremendous advances made in increasing agricultural productivity through the application of modern technology .

In this present proposal , we begin with an overview of some challenges facing on global agriculture . In this section we will proceed with new-some technologies , implemented together which will be helpful for modern agriculture .

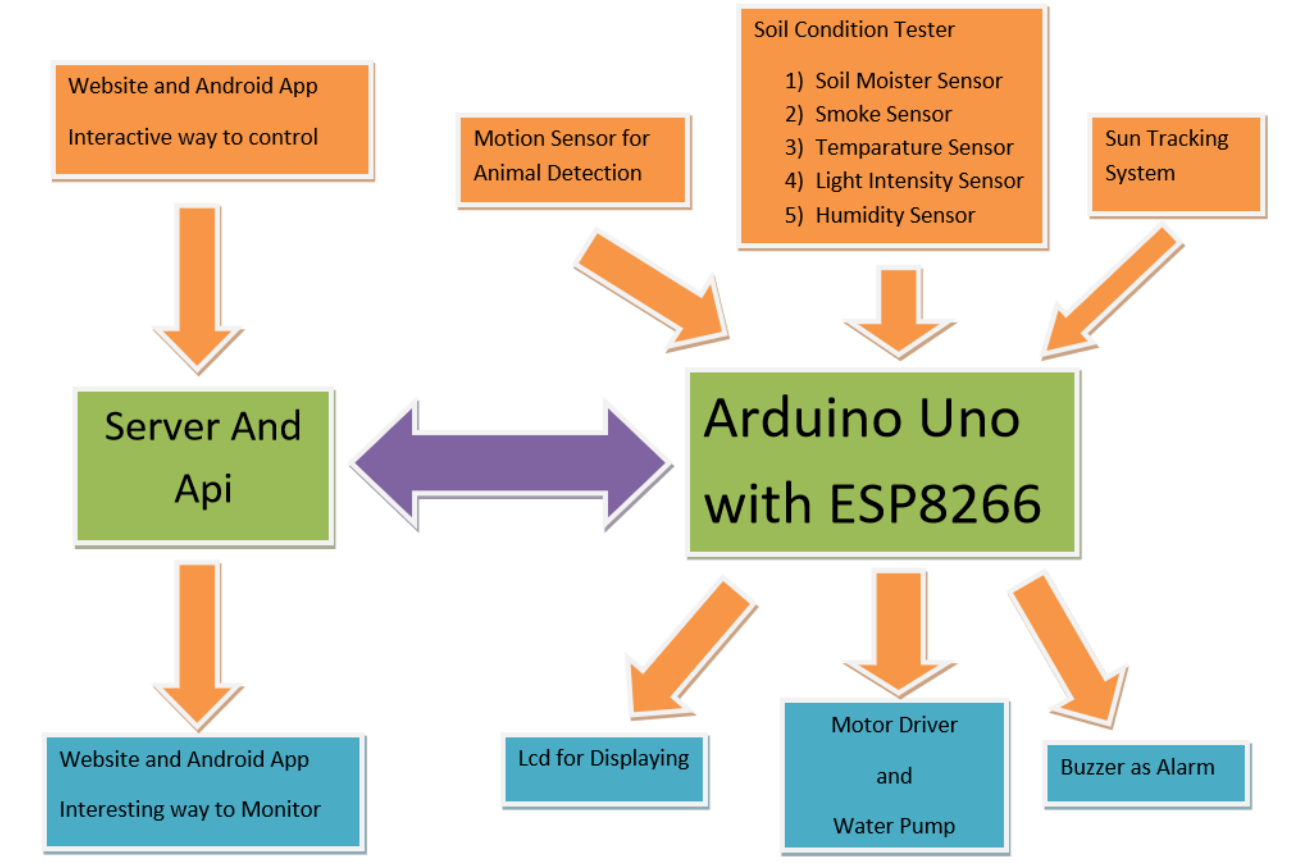
- **Testing the soil-moisture of agriculture field :** As it is more accurate and effective to understand the moisture content of the field .

- **Testing the temperature of the atmosphere :** It is better to predict the temperature .
- **Testing the field humidity :** It measures the moisture content of the atmosphere in the land area which is going to help the farmers . They can also predict about rainfall .
- **Launch electronic scare-crow :** As the normal one acts as a statue even it is known to birds also . The electronic will do some activities to save the crops from those birds .
- **Start the water-pump through internet (manually or automated):** As we all know many of our farmers have to travel a long distances to start the water pump and then wait till the end and this takes a huge time . Now they can on-off the water pump via APP or API .
- **Run the whole system using solar power :** As maximum of agricultural fields are out of proper electric services .And we can use the solar tracking system on that .
- **Two or more field study :** Farmers can select the field number with the help of Android App or API to start the corresponding water pump .

Project Overview :

In this proposed agricultural system IOT is implemented , in this system all the information that are received via sensors and various parameters are given to the arduino micro-controller as an analog input . A preset value of the soil moisture , temperature , humidity , PIR sensors are fixed in microcontroller and also for fencing . When it goes beyond the particular threshold value , water is automatically irrigated to the crops and once the required amount of water is fulfilled it will stop(automatically / manually) . The microcontroller transmit that information on the internet through a network of IOT in the form of WiFi module ESP8266 attached to it . This enhances automated irrigation as water pump can be switched on/off through information given to the controller . This approach is for advanced agricultural process by automatic method without manpower by measuring various parameters related to the field and thus improves agriculture .

Block diagram of the smart system :



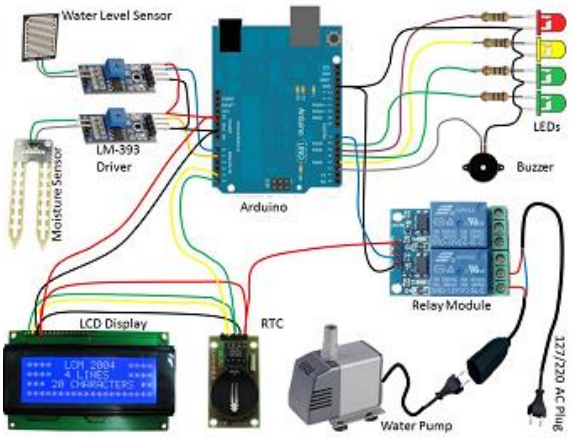
This is the block diagram of the smart agricultural system .This whole system is automated by the arduino microcontroller and the ESP8266(WiFi module) .

1. Sensors(input devices) :

The following soil-moisture sensor, smoke sensor , temperature sensor , light intensity sensor , humidity sensor etc are used to sense the atmospheric condition of the particular time and send the data to the microcontroller to verify the present situation . A PIR motion sensor is used to trace the presence or movement of any unwanted creature near the crop-field .

The another smart sun-tracking system is used to track the sun's movement throughout the day . An LDR(light dependent resistor) is used to measure the intensity of light and via servo motor the solar panel can rotate accordingly . This solar tracking system will produce sufficient amount of electricity to fulfil the demand of power required for running the whole system efficiently .

2. **Output Devices :**



Lcd display will show the temperature , humidity , light intensity, soil-moisture content . Thus farmers can easily understand the present situation and can take decisions immediately .

A high-pitch buzzer is used to alert the unwanted creatures in the crop-field like birds , rats etc .

A powerful motor (with motor driver) is directly connected to the micro-controller to pump the water in the farming-field ,when it's needed .

3. **Website and android app :**

This whole smart system can be automated by the microcontrollers , but the farmers can take several decisions manually depending on the situations . A web facility will provide the all information to the farmers to understand the present condition of the atmosphere and soil of their field even if they stay far away from the crop-field . For convenience purpose an android app is there to provide the same information briefly for the smart-phone users .

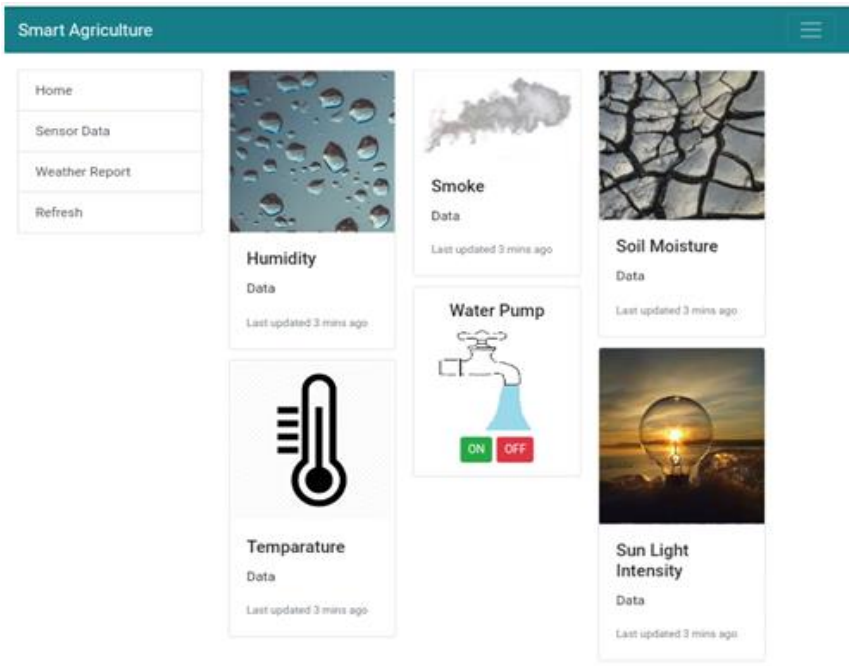
Data collected by the sensors

Days	TEMPERATURE		HUMIDITY		Soil Moisture
	Min	Avg	Min(%)	Avg(%)	Avg(%)
1	19°C	35 °C	29%	44%	64
2	21°C	36 °C	22%	37.70%	62
3	19°C	34 °C	22%	45.50%	63
4	20°C	33 ° C	34%	47%	65
5	22°C	34 ° C	38%	57.80%	64
6	20C	31 °C	37%	64%	62
7	19°C	32 °C	29%	53.80%	61

4. **Features of the android and web facility:**

With the help of Google weather-API the website will predict weather condition for the next few days , that will help the farmers to defend the upcoming situations .

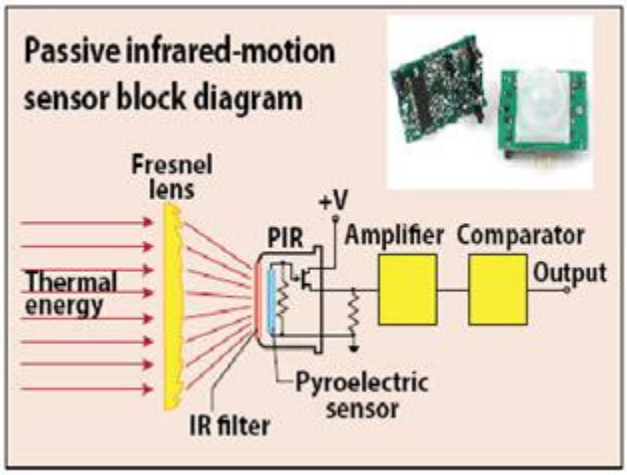
In some cases the automated system decision might not matched with farmer's wish . So a manual pump-driving option will be provided to the dashboard , which will be manually controlled by farmers in some situations .



For the convenience of the farmers the website will be Google translated and android app can be run in different local languages .

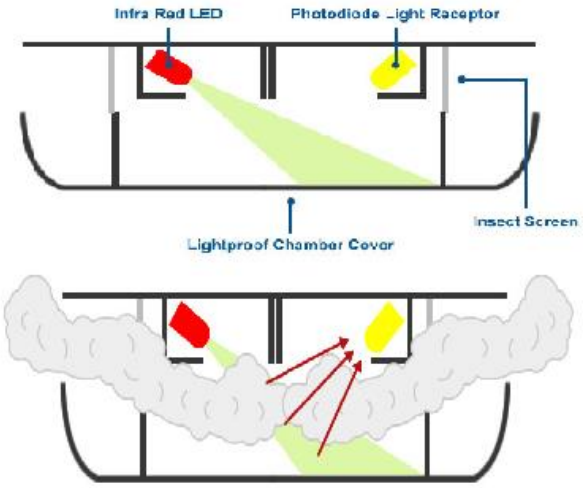
Features of the various sensing devices used in this project:

P.I.R (passive infrared) Sensor :



PIR sensor allows to sense motion , almost always used to detect whether a creature has moved in or out of the sensor's 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 business . They are often referred to as PIR , "passive infrared" , "pyroelectric " , or "IR motion" sensors.

PIRs are basically made of a pyroelectric sensor (which can be seen as the round metal can with a rectangular crystal in the centre) , 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 .

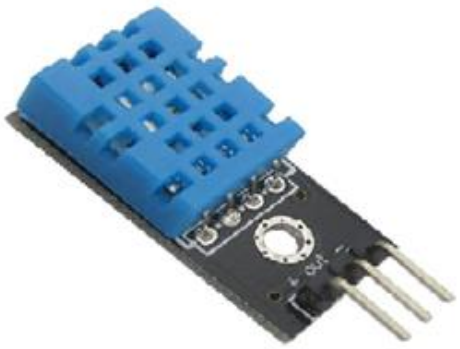


Smoke Sensor :

An optical smoke sensor(also called photo-electric smoke alarm)works using the light scatter principle. The alarms contains a pulsed infrared LED which pulses a beam of light into the sensor chamber every 10secs to check for the smoke particles. When a fire breaks out smoke will enter the optical chamber through the opening vents. Smoke alarms from quality manufacturers have the chamber protected with insects screen to stop bugs from entering and causing false alarms. As the smoke enters the optical chamber, its particles causes the infrared light to be scattered onto the photodiode light receptor. Once the scattered light hits the photodiode light receptor, a signal is sent to the integrated circuit.

Humidity Sensor :

Humidity sensor works by detecting changes that alter electrical currents or temperature in the air . There are three basic types of humidity sensors : capacitive , resistive and thermal . All three types of sensors monitor minute changes in the atmosphere in order to calculate the humidity in the air .

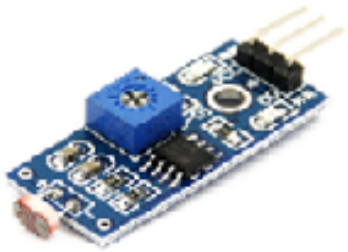


Capacitive : A capacitive humidity sensor measures relative humidity by placing a thin strip of metal oxide between two electrodes . The metal oxide's electrical capacity changes with the atmosphere's relative humidity . Whether , commercial and industries are the major application areas .

Resistive : Resistive humidity sensors utilize ions in salts to measure the electrical impedance of atoms . As humidity changes , so does the resistance of the electrodes on the either side of the salt medium .

Thermal : two thermal sensors conduct electricity based upon the humidity of the surrounding air . One sensor is encased in dry nitrogen while other measures the ambient air . the difference between the two measures the humidity .

L.D.R (light dependent resistor) Sensor :

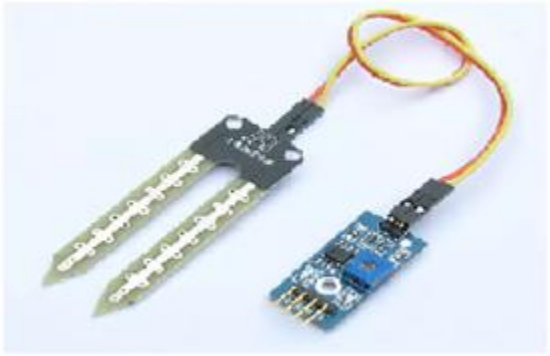


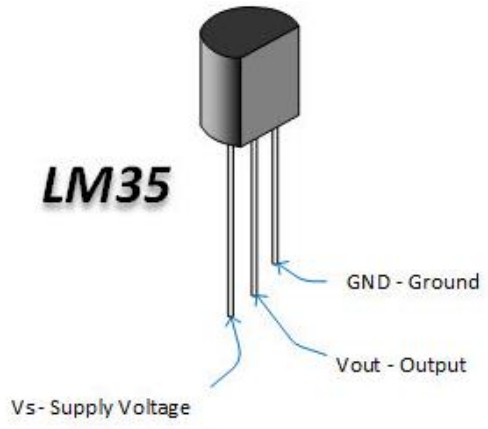
This resistors work on the principle of the photo conductivity . It is but when the light falls on its surface , then the material conductivity reduces and also the electrons in the valance band of the device are excited to the conduction band . These photons in the incident light must have energy greater than the band gap of the semiconductor material . This makes the electrons to jump from the valance band to conduction band .

These devices depend on the light , when light falls on the LDR then the resistance decreases , and increases in the dark . When a LDR is kept in the dark place , its resistance is high and , when the LDR is kept in the light its resistance will decrease .

Soil moisture Sensor :

The soil moisture sensor uses capacitance to measure dielectric permittivity of the surrounding medium . In soil , dielectric permittivity is a function of the water content . The sensor creates a voltage proportional to the dielectric permittivity , and therefore the water content of the soil . The sensor averages the water content over the entire length of the sensor . There is a 2 cm. zone of influence with respect to the flat surface of the sensor , but it has little or no sensitivity at the extreme edges . The soil moisture sensor is used to measure the loss of moisture over time due to the evaporation and plant uptake , evaluate optimum soil moisture content for various species of plants , monitor soil moisture content to control irrigation in greenhouse and enhance bottle biology experiments .





Temperature Sensor :

The LM35 is one kind of commonly used temperature sensor that can be used to measure temperature with an electrical o/p comparative to the temperature (in °C). It can measure temperature more correctly

compare with a thermistor. This sensor generates a high output voltage than thermocouples and may not need that the output voltage is amplified. The LM35 has an output voltage that is proportional to the Celsius temperature. The scale factor is .01V/°C. The output of this sensor changes describes the linearity. The o/p voltage of this IC sensor is linearly comparative to the Celsius temperature. The operating voltage range of this LM35 ranges from-55˚ to +150˚C and it has low-self heating. This is operated under 4 to 30 volts. The most extensively used electronic devices are operational amplifiers, which are certain kind of differential amplifiers.

All component list :

Input Devices	Output Devices
1. PIR sensor 2. LDR sensor 3. LM35 Temperature sensor 4. Smoke sensor 5. Humidity sensor 6. Soil moisture sensor	1. LCD display 2. Water pump 3. High pitch buzzer 4. Servo motor

Control Devices	1. Arduino Uno 2. ESp 8266 WiFi module 3. Web server and android app

Conclusions :

As the new technologies are increasing day by day , our model has been made compatible with new technologies and old technologies used in a modern way which would be beneficial for the local farming as well as in different agriculture related institutions and organizations. In a world where automation is given maximum preferences, we had lead our project to that extent where data are continuously fetched in a periodic manner and they are processed and stored for future study. Moreover for country where maximum revenue depends on agriculture, we think our model will

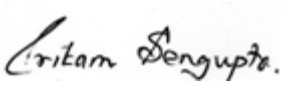
make agricultural system simpler and will provide easy way to access which will definitely lead to growth of the country. We have included various section in our model which in total helps to give a brief study of the land and to access when needed.

a. Soil testing by our model will lead to know various aspects of the land in a single point of time, i.e. moisture content , temperature , humidity, light etc. Climate conditions are tested for proper harvesting of crops. Moreover it helps to increase the productivity of the soil by moisture levels , nutrients and if proper soil is not present fertilizers can be added for better cultivation.
b. Electronic scarecrow which is another interesting section where presence of any animal, birds or pests can be detected in the farm land and makes sounds and various actions by which birds gets away. It covers a range of 5metres.
c. Solar tracking devices will help to save and use the renewable source of energy for supply to the system. The electricity problem of villages can be solved up to some extent.
d. IOT which is the next advanced section where the data are collected from field are stored in a regular basis in the server, that we have designed for this purpose and from where we can access the track record of individual sections of the field and can get a total overview of the production land. Stored data can be utilized for further detail led study of the land for more than 10 years.
e. The main interesting fact is that the whole system can be overviewed through android application also which we have designed separately for better user interactions.

Future scopes :

- **Farm bots** can be implemented to help the farmers for improvement in horticulture or greenhouse cultivation, while the plant the seeds or trees and further well infrastructure research can add many thing to this model.
- **Sorting of pests through Image processing** as pests are the main reasons to destroy crops completely, so sorting and identifying the pests is very necessary for proper cultivation.
- We have only implemented a little portion of IOT, where we have stored the sensor value to our API so that it can be accessed from anywhere.
- **Observation of depth of soil parameters** to have better knowledge of the soil, we have to take records of the soil at different level in different weather conditions. As we know that the other parameters varies with the depth of soil.

Signature :



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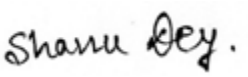

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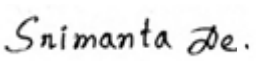

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