



**Patent Search and Analysis Report (PSAR) Reports**  
submitted as a part of the

**PROJECT REPORT**

**“IOT Based Irrigation System”**

**Submitted by:**

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**In partial fulfillment for the award of the degree Of**

**BACHELOR OF ENGINEERING**  
**in**

**Branch Name - Electronics & Communication**

**College Name - L.J. Institute of Engineering & Technology**

**Gujarat Technological University**  
**Ahmedabad**



## **L.J. Institute of Engineering & Technology**

### DECLARATION

We hereby declare that the PSAR Reports, submitted along with the Project Report for the project entitled “**IOT Based Irrigation System**” submitted in partial fulfillment for the degree of Bachelor of Engineering in Electronics & Communication Branch to Gujarat Technological University, Ahmedabad , is a bonafide record of the project work carried out at **L.J. Institute of Engineering & Technology** under the supervision of **Prof. Mosam Pandya** and that no part of any of these PSAR reports has been directly copied from any students’ reports or taken from any other source, without providing due reference.

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## **L.J. Institute of Engineering & Technology**

# CERTIFICATE

This is to certify that the PSAR reports, submitted along with the project entitled “IOT Based Irrigation System” has been carried out by

Yash Bajaria, Siddharth Nahar, Devansh Shah, Jainil Shah under my guidance in partial fulfillment for the degree of: Bachelor of Engineering in Electronics & Communication Branch 7th Semester of Gujarat Technological University, Ahmadabad during the academic year 2020-21. These students have successfully completed PSAR activity under my guidance.

**Internal Guide**

Prof. Mosam Pandya

**Head of the Department**

Prof. Mosam Pandya

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## 1.) A.E.I.O.U. Summary:

<b>AEIOU Summary:</b>		Group ID: 114694 Domain Name: IOT	Date: 03 - 10 - 2020    Version: v1.0
<b>Environment:</b> <ul style="list-style-type: none"><li>- Farms.</li><li>- Fields.</li><li>- Villages.</li><li>- Houses.</li></ul>	<b>Interactions:</b> <ul style="list-style-type: none"><li>- Farmers ~ Motors.</li><li>- Teachers ~ Lights.</li><li>- Shop Owners ~ Fans.</li><li>- Employees ~ Air Conditioner</li></ul>	<b>Objects:</b> <ul style="list-style-type: none"><li>- Motors.</li><li>- Lights.</li><li>- Air Conditioner.</li><li>- Fans.</li></ul>	
<b>Activities:</b> <ul style="list-style-type: none"><li>- Reading.</li><li>- Switching ON.</li><li>- Switching OFF.</li><li>- Setting Timer.</li><li>- Messaging.</li></ul>		<b>Users:</b> <ul style="list-style-type: none"><li>- Farmers.</li><li>- Teachers.</li><li>- Employees.</li><li>- Shop Owners.</li></ul>	

## **Abstract:**

- Automation of farm activities can transform agricultural domain from being manual and static to intelligent and dynamic leading to higher production with lesser human supervision. Water management is paramount in countries with water scarcity. This also affects agriculture, as a large amount of water is dedicated to that use.
- Most of the farmers use large portions of farming land and it becomes very difficult to reach and track every corner of the large land. Sometimes there is a possibility of uneven water sprinkles. This result in the bad quality crops which further leads to financial loses. In this using **IOT Based Irrigation System** is helpful and ease of farming.
- We present a survey aimed at summarizing the current state of the art regarding intelligent irrigation systems. We determine the parameters that are monitored in irrigation systems regarding water quantity and quality, soil characteristics and weather conditions. We provide an overview of the most utilized nodes and wireless technologies. Lastly, we will discuss the challenges and the best practices for the implementation of sensor-based irrigation systems.
- The setup uses soil moisture sensors which measure the exact moisture level in soil. This value enables the system to use appropriate quantity of water which avoids over/under irrigation. IOT is used to keep the farmers updated about the status of sprinklers.





## **Keywords:-**

Irrigation, IOT, Precision Agriculture, Soil Moisture Sensors, Micro-controller, GSM Module, Lora Module, Switches, Buttons.

## **Aims & Objectives:**

- Agriculture is the major backbone of Indian Economy. Most of the available fresh water resources are used in Agriculture. The agricultural sector is one of the most important economic resources in these countries adding to the importance of managing well the available water resources to ensure the continuing of this economical sector.
- Due to the recent advances in sensors for the implementation of irrigation systems for agriculture and the evolution of WSN and IoT technologies that can be applied in the development of these systems. In this survey, we are going to provide an overview of the state of the research regarding irrigation systems. We will determine the parameters that are monitored in irrigation systems regarding water quantity and quality, soil characteristics, weather conditions, and fertilizer usage.
- In the recent years automated and semi- automated technologies been deployed for irrigating the field which has replaced the traditional Agricultural mechanism. The cloud and IOT technology in recent year entered agriculture and by using these two technologies the farmer is increasing production and reducing cost. In this paper a system is discussed which uses both cloud and IOT technologies for controlling the irrigation system. The system discussed comprises many elements for performing specific task.
- For the next generation agriculture fields, data collected from sensors would become the fertilizer to grow crops. It's really perplexing, but true. IOT would uncover the new ways that tap the full potential of agriculture yield and alleviate all the challenges that hinders the growth of the crop.

## 2.) Ideation Canvas:

The Ideanaut: <i>Ideation Canvas</i>		Project: IOT Based Irrigation System	Team: 114694
<div> People</div> <div>- Farmers.</div> <div>- Shopkeepers.</div> <div>- Employees.</div> <div>- Teachers.</div>			
<div> Activities</div> <div>- Reading.</div> <div>- Switching ON.</div> <div>- Switching OFF.</div> <div>- Setting Timer.</div> <div>- Messaging.</div>	<div> Situation/Context/Location <small>(What / When) (Why) (Where)</small></div> <div>- Farms.</div> <div>- Fields.</div> <div>- Villages.</div> <div>- Houses.</div>		
<div> Props/Tools/Objects/Equipment</div> <div>- Increases Productivity.</div> <div>- Reduces Water Wastage.</div> <div>- Reduces hassle to roam in farms.</div> <div>- Even a laymen can use.</div> <div>- Ease of Use.</div> <div>- Assures Safety.</div>			
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- An ideation canvas is a rough whiteboard where ideas can be stretched into any limits or dimensions. Ideation session is not aimed at finding solutions to the defined problem, but to define the best possible problem and stretch out its possible scope. The ideation canvas is separated into various sections such as users, activities, situations, props.

### 3.) Product Development Canvas:

Product Development Canvas		Team/Date/Version:
<p><b>1. Purpose</b></p> <p>What is the purpose of this product you're developing? Does it solve a problem, or it enhances a certain experience? Or it solving a need, or trying to create a new need or tap an untapped need?</p> <p>- Makes a farmers job easy</p> <p>- Centralises Motors management.</p> <p>- Can be also used in other domains as IOT device</p>	<p><b>2. Product Experience</b></p> <p>Define when your customers should feel like when they use your product/service? What emotions, feelings would define this experience? (Feeling of comfort, convenience, saving time, or saving more with less cost, satisfaction, feeling of greater security, safety etc.)</p> <p>- Convenience      - Cheap      - Easy to Use</p>	<p><b>3. Customer Revalidation</b></p> <p>Once you're finished with your feature set, test with the customer/user. If the features, functions are useful. Speak to the customer/user.</p> <p>- Cheap.</p> <p>- Time Saving.</p> <p>- Compact.</p> <p>- Easy to Use.</p>
<p><b>4. People</b></p> <p>Who is the key stakeholder segment, who will use this product? (Describe the end product or the concept you're creating?)</p> <p>Write here about them, describe them a little.</p> <p>- Product is specifically designed for farmers i.e Agriculture &amp; Irrigation purposes.</p> <p>- As it is an IOT device it is also used by Employees, Teachers, Shop Owners etc.</p>	<p><b>5. Product Functions</b></p> <p>Functions are a means to answer to user problems/needs. They do something that user wants. They are often verbs in nature. Every function is powered by many things. An interesting is a function. However this is a feature that powers the underlying function. A function can have one or more features powering it. And vice versa, when you think of a function, you often think of specific features that power it. Functions are similar to product experience. Safety, Product function provides a feeling of safety, comfort, convenience.</p> <p>- Reduces hassle in farms.      - Reduces Water Wastage.</p> <p>- Ease of Use.      - Increases Productivity.</p>	
	<p><b>6. Product Features</b></p> <p>Products features are specific. One or more features will power a function. An example is a feature that powers the safety function. Browser tabs, Apple's home button, a combination between two are features powering the underlying function. Each feature will have many components/sub-components powering it. Sometimes, very similar component sometimes feature itself. Like car door is a major component and a feature at the same time powering the in car entertainment system, power windows, entertainment as a product experience.</p> <p>- Even a laymen can use.      - Switchboard type interface.</p> <p>- Assures Safety.      - Compact.      - Long Range.</p> <p>- Reduces Water Wastage.      - Saves Resources.</p> <p>- Easy Indication using LED Lights.</p>	
	<p><b>7. Components</b></p> <p>Components build up the features. For an IOT device, it will comprise a lot of components like, chips, sensors, etc. (Think of the components). For a switchboard, it will comprise of various components like, switches, buttons, etc. In cases where the feature is a minor component, you could try to have the sub-components that are sensitive to make the minor component work (you could try to have adjustments and innovations you're planning here at the components level).</p> <p>- Microcontroller.      - LoRa Module.      - Buttons.      - LED.</p> <p>- GSM Module.      - Buzzer.      - Soil Moisture Sensor.</p> <p>- Display Board.      - Switches.      - Potentiometer.</p> <p>- Power Supply.      - Battery Management System.</p>	<p><b>8. Reject, Redesign, Retain</b></p> <p>From customer validation, reject those functions or features that the customers don't like, redesign those that were partially useful, and retain those that the customers like. (Think of the features, functions, and components that are useful).</p> <p>- Add some repeaters for even longer Range.</p> <p>- Add Safety for Animals / Birds that worsens crops.</p>

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- The product Canvas is a strategic product planning tool that allows you to quickly capture, describe, challenge, and pivot your product strategy on just a single page.
- The Product Canvas has helped us to identify what are the top customer problems we're trying to solve, the underlying assumptions in our proposed solution, and what we really need to learn from our customers.



## **Technologies Used So Far:**

- The available traditional methods of irrigation are drip irrigation, sprinkler system. The current irrigation methodology adopted employ uniform water distribution which is not optimal. So accordingly technologies being applied towards agricultural monitoring which is required by farmers.
- Standalone monitoring station, Wireless Sensor based monitoring system been developed which is composed of number of wireless sensor nodes and a gateway. Agriculture Modernization that has already started by some of the tech savvy farmers. For the next generation agriculture fields, data collected from sensors would become the fertilizer to grow crops.
- In addition to employing technologies in monitoring the agriculture for automating the irrigation system, there is need for some intelligence which allows machines to apply some intelligence in interpreting agricultural data captured and accordingly analyze data towards predicting the output rather than following traditional rule based algorithm. So towards this, Artificial intelligence plays a key role which allows devices to learn without being explicitly programmed.
- Most of the system just captures the data from the field and accordingly controls the sprinkler valve for watering the field. In none of these systems, there exists intelligence which analyses the real time data based on past experience for irrigating the field.

## **Literature Survey:**

### ➤ **Existing Systems:**

- A.** Traditional Agricultural Monitoring
- B.** ICT Based Agricultural Monitoring
- C.** Paddy Growth Monitoring System
- D.** Machine Learning in Agricultural Monitoring

## **Materials and Methods:**

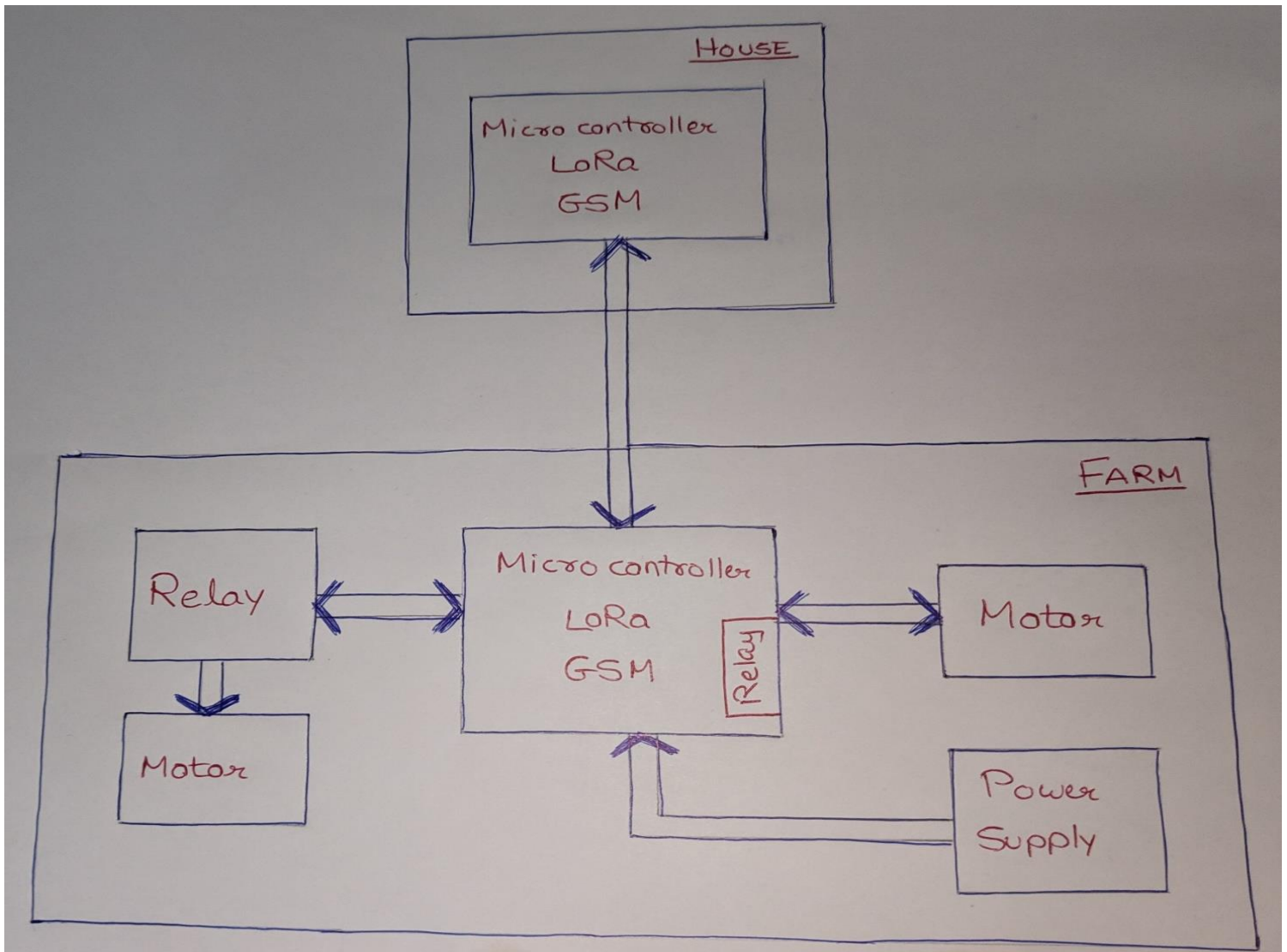
- The **IOT Based Irrigation System** which is capable of automating the irrigation process by analyzing the moisture of soil and the climate condition (like raining). It provides water supply at the right time, in right quantity and at the right place in field which plays a vital role in the plant's growth.
- By using sensors like moisture, rain, etc. water supply for irrigation can be managed easily by analyzing the condition of soil and climate. Soil moisture sensors smartly measure the soil moisture and based on that data, field is getting irrigated automatically with less human interventions. The complete data of moisture is accessible to the farmers at distance on the mobile also.
- Intelligent IOT based automated irrigation system where the moisture sensors deployed in field communicate to microcontroller. The sensed moisture value is then transmitted using serial communication to microcontroller. Micro Controller then sends this field data to another microcontroller through the means of GSM module or LoRa module.
- The system here consists of following components. Firstly the Microcontroller part where Soil Moisture deployed in soil is connected to Microcontroller which gives the moisture output based on soil condition. The data received by Microcontroller are then manipulated based on Custom Algorithm.
- Custom Algorithm been employed for monitoring the soil condition based on Moisture level. The predicted output is then used for sending the control signal via the serial communication to Microcontroller for controlling water pump for watering the field accordingly.

## Circuit Diagram & Flow Chart:

- Micro-Controller
- LoRa Module
- GSM Module
- Soil Moisture Sensor
- TFT Display Board
- Power Supply
- Potentiometer
- LED's
- Battery Management System
- Buttons
- Buzzer



## Circuit Diagram & Flow Chart:



## **Methodology:**

- Water sprinkler control was achieved by setting a threshold value at which irrigation should begin. When the sensors switched on the moisture content is low. The threshold values depend on the type of soil used. API for the Internet of Things that enables you to collect, store, analyze, visualize, and act on data from sensors or Micro- controllers. Lora Module is also used here to enhance the range capacity of the system.
- The values obtained through sensors enable the system to switch the sprinkler on and off. A farmer can remotely monitor the irrigation process on the farm. The soil moisture, rain and the control unit act accordingly to sensed data and control the water pump.

## **Outcomes:**

- The Intelligent IOT based Irrigation System developed involves Micro-Controller as processing unit. In addition Moisture Sensors deployed in soil for sensing the soil moisture level. These sensors are connected to microcontroller where sensed information sent to the microcontroller for action. In addition to these sensors, the actuator for water pump also connected to sensors for pumping the water.
- The System is not only used in field by the farmers but can be used to solve other problems where continuous monitoring of water supply is required like in a garden, or a personal small field, or in the watering the stadium when necessary etc. It optimally controls the water pump and highly reduced the electricity consumption of farm and the production of farm is increased because of controlled water supply to crops.

## 4.) Implementation Story:

Design For IOT Based Irrigation System Design By Devansh, Jainil, Siddharth, Yash

Date 03 - 10 - 2020

Version v1.0

<b>USER</b> <ul style="list-style-type: none"><li>- Farmers.</li><li>- Employees.</li><li>- Teachers.</li><li>- Shopkeepers</li></ul>	<b>STAKEHOLDERS</b> <ul style="list-style-type: none"><li>- Farmers.</li><li>- Technician.</li><li>- Head of Department / Principal.</li><li>- Housekeepers.</li></ul>
<b>ACTIVITIES</b> <ul style="list-style-type: none"><li>- Reading.</li><li>- Switching ON.</li><li>- Switching OFF.</li><li>- Setting Timer.</li><li>- Messaging.</li></ul>	
<b>STORY BOARDING</b> <b>HAPPY</b> <ul style="list-style-type: none"><li>- Due to proper irrigation system, the crops yielded nicely and was sold for good prices due to which farmer was able to complete his family needs.</li></ul>	
<b>HAPPY</b> <ul style="list-style-type: none"><li>- This year we were able to save the cost of water purification due to proper irrigation system ; even water wastage was avoided and tonnes of safe filtered water was saved.</li></ul>	
<b>SAD</b> <ul style="list-style-type: none"><li>- Due to Odd Times of Water Release at farm, farmers need to go and roam in farms to start motors even at 4 am and after an hour go again to turn off the motors having running water.</li></ul>	
<b>SAD</b> <ul style="list-style-type: none"><li>- Due to owning a very big farm, Farmer forgot starting a motor in field of cotton crops, due to which the field dried and many crops got damaged. He suffered a very big monetary loss due to that.</li></ul>	

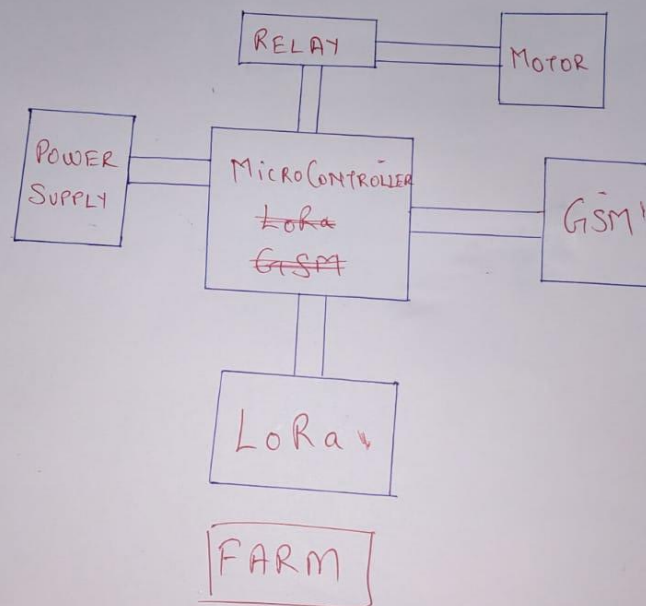
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## **Conclusion & Future Perspects:**

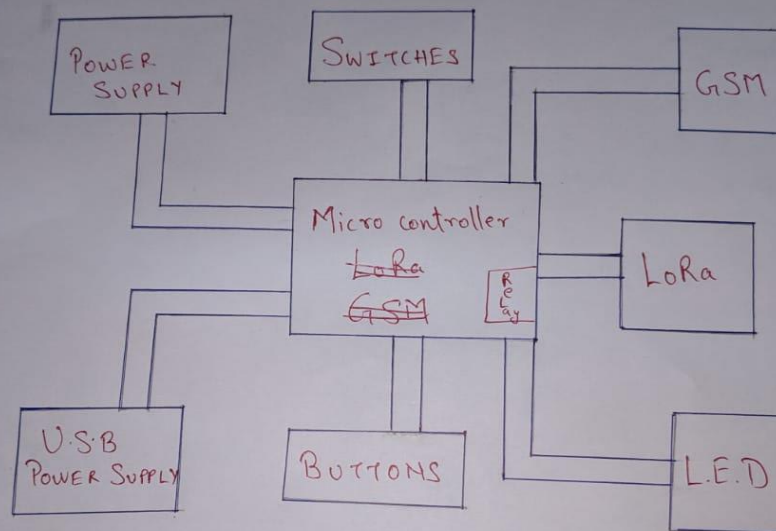
- Agricultural monitoring is very much needed to reduce much of human labor and at the same time minimize on water usage. Lot of system been developed employing Wireless Sensor in monitoring and predicting the soil condition for irrigating the field. In addition machine learning techniques been employed towards crop yield and crop disease prediction only.
- IOT Based Irrigation System presented over here results in complete automated irrigation system employing IOT Technologies where devices communicate among themselves in predicting the soil condition for watering the field. This proves that the use of water can be diminished and hence water will not be wasted as compared to the present records. It reduces the human resources. This irrigation system will be feasible and cost effective for optimizing water resources for agricultural production. The irrigation system can be adjusted to a variety of specific crop needs and requires minimum maintenance.
- Furthermore, the Internet link allows the supervision through mobile telecommunication devices, such as a Smartphone. Besides the monetary savings in water use, the importance of the preservation of this natural resource justify the use of this kind of irrigation systems. Project concludes that automation of irrigation system will become easy and comfortable for farmers to operate the irrigation at remote location i.e. from their native. This will save time, avoid problem of continuous vigilance, help in sustain the productivity and increasing the yield.
- In Future, Intelligent IOT based Irrigation system can be extended not just for irrigating the field with water but also for deciding on spraying appropriate chemicals for proper growth of crop. The same work can be extended by looking into water level in tank before irrigating the field. Lastly the data security and integrity of agricultural data can be secured while transmitting for analysis towards prediction and sending the control signal for actuation.



### Circuit Diagram:







HOUSE