Smart Irrigation/Agriculture System

Team Name : **The Rectifiers**
Group: **A1**
Team Members :
1. Amey Chhaya
2. Abhiroop Bhavsar
3. Deekshant Singh
4. Ankit Shaw
5. Abhinav Gupta
6. Anjali Sharma
7. Abhishek Yadav
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Motivation :

To develop an automatic smart irrigation system with a user friendly interface, which has agricultural as well as domestic applications.

- The aim is to create a sensor based system which enhances the efficiency of our lives.
- We shall also get to know about a lot of new elements like microprocessor, GSM modem, and non technical aspects such as complexity of circuits, comparison between circuits etc.
- To make the pre-existing systems more reliable and efficient.

PROBLEM STATEMENT:

The in-use agricultural systems have scope of improvement. We are trying to take a step in that direction.

Multiple applications are possible of the sensor communication system, for example Fire detection and alarming system, Smart agricultural irrigation system, Snake detection system, etc.

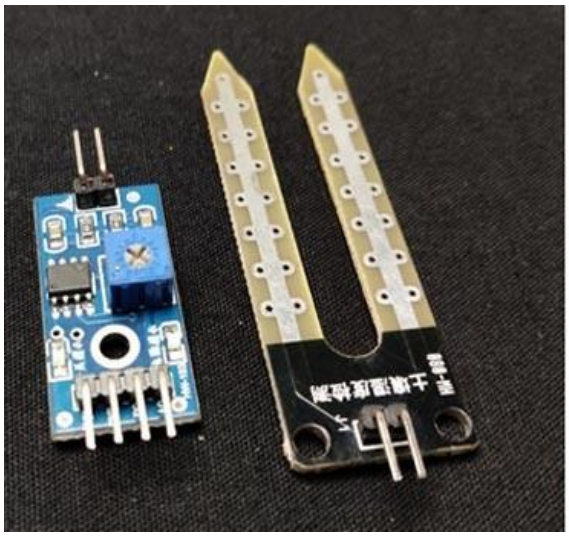
All we need is, specific sensors to detect the trigger factor, required system for signal conversion and transmission to the people responsible to solve the issue. Here, we shall explore the Smart irrigation system.

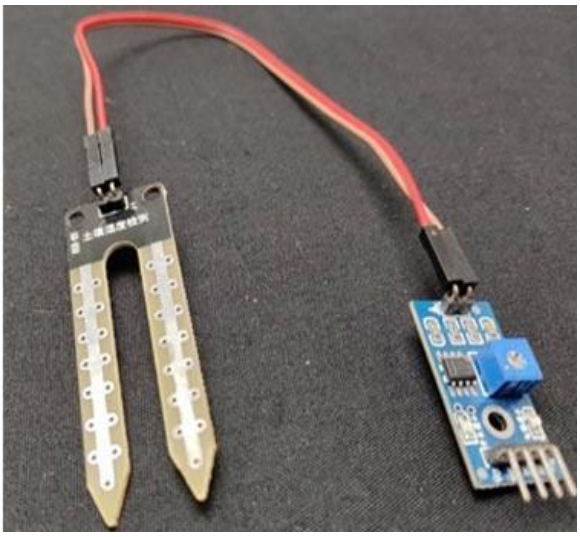
SMART IRRIGATION SYSTEM

Working of the Automatic Irrigation System

The logic of this system is very simple. In this system, the moisture sensor senses the moisture level of the soil and when the sensor senses a low moisture level it automatically switches the water pump with the help of a microcontroller and irrigates the plant. After supplying sufficient water, the soil retains the moisture hence automatically stopping the pump.

Soil Moisture Sensor .

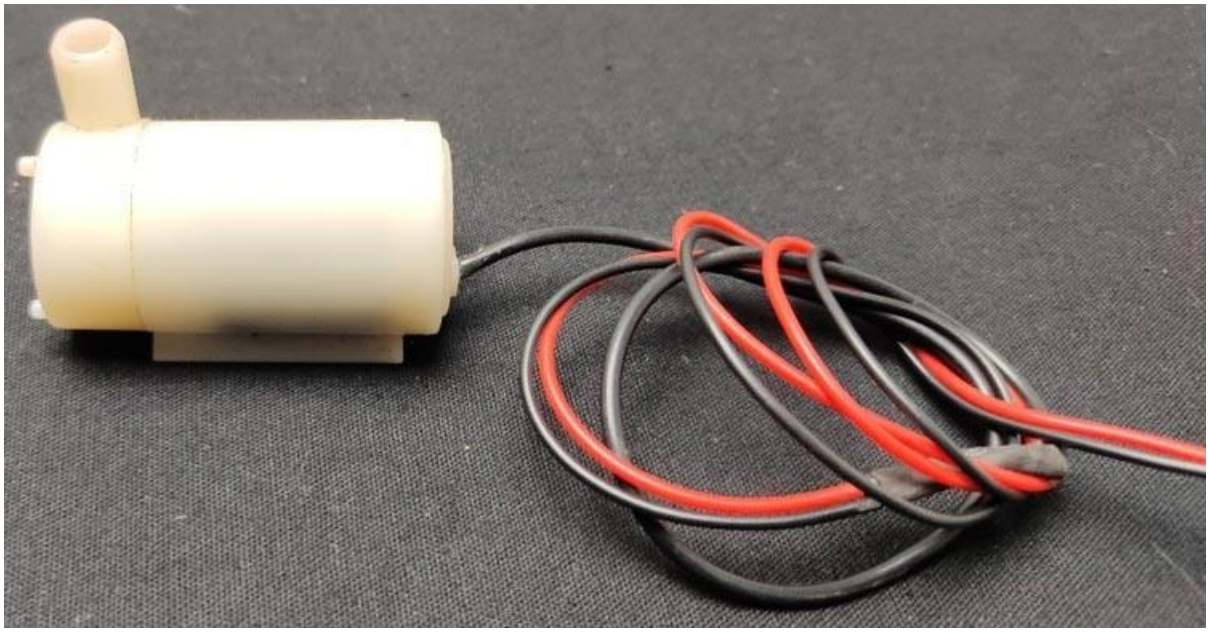




The working of the soil moisture sensor is very easy to understand. It has 2 probes with exposed contacts that act like a variable resistor whose resistance varies according to the water content in the soil. This resistance is inversely proportional to the soil moisture which means that higher water in the soil means better conductivity and hence a lower resistance. While the lower water in the soil means poor conductivity and will result in higher resistance. The sensor produces an analog voltage output according to the resistance.

The sensor comes with an electronic module that connects the probe to the Arduino. The module has an LM393 High Precision Comparator which converts the analog signal to a Digital Output which is fed to the microcontroller.

Pump

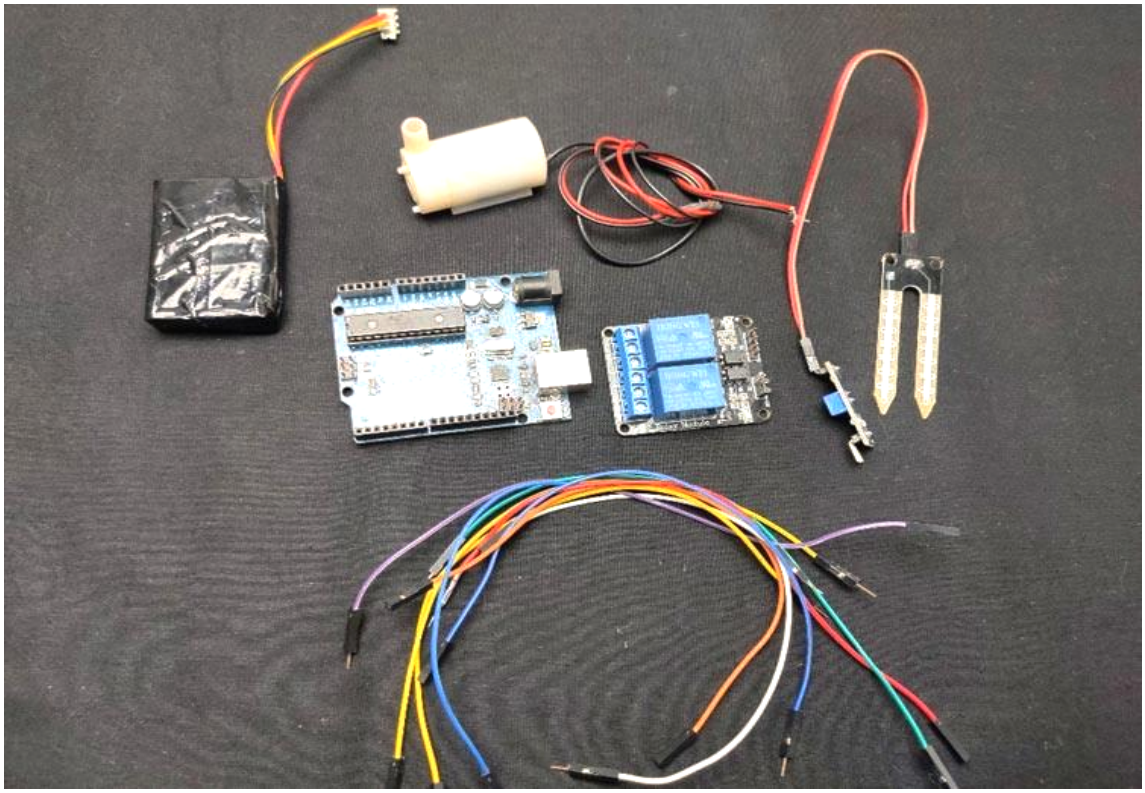


We need a small pump to irrigate the plant, but in the case of a garden, we need to drive a larger pump that can provide a higher volume of water depending on the size of your garden which can't be directly powered by an Arduino. So in case of the need to operate a larger pump, a driver is necessary to provide enough current for the pump, so we used a 5v relay. You can also use an AC-powered pump and use a suitable relay. The working will remain the same as shown in this project, you just have to replace the DC power input connected to the relay with an AC power input and have to power your Arduino with a separate DC power source.

Components Required for the Automatic Irrigation System

The project requires very few components and the connection is also very simple. The components are listed below:

- Arduino * 1
- moisture sensor * 1
- 5v relay module * 1
- 6v Mini water pump with small pipe * 1
- Connecting wires
- 5v battery * 1



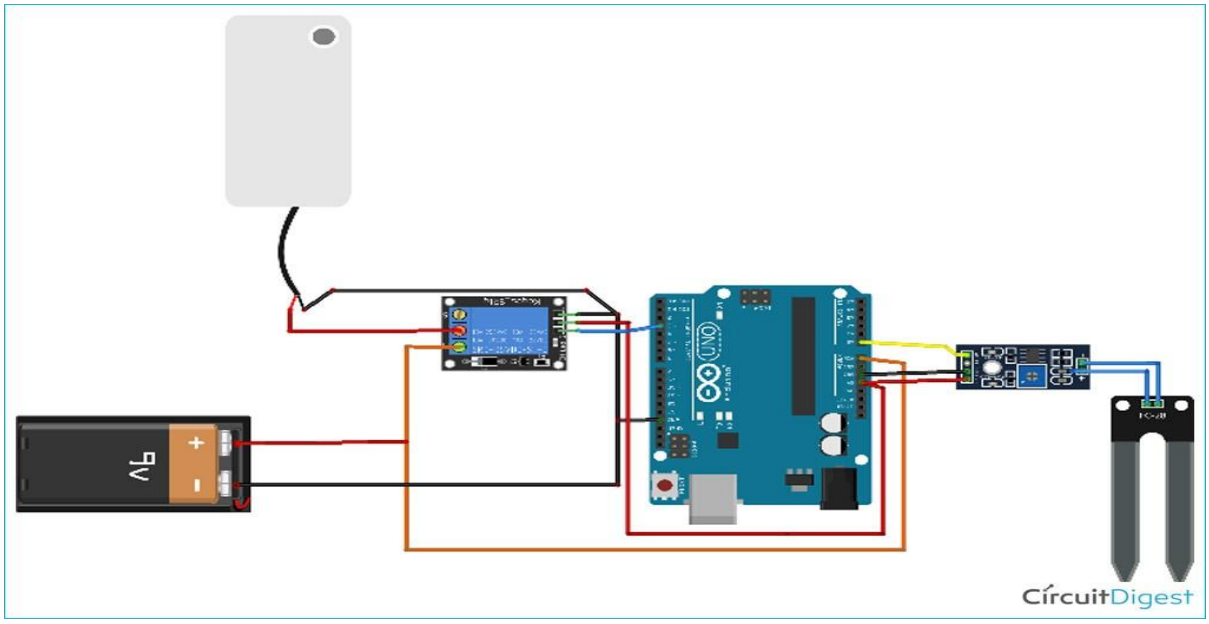
Cost Table

S.no	Materials Required	Cost
1.	Arduino	1802
2.	moisture sensor	385
3.	5v relay module	335
4.	6v Mini water pump with small pipe	149
5.	Connecting wires	130
6.	5v battery	35

Circuit Diagram of the Arduino Automatic irrigation system

The complete circuit diagram for the Arduino Automatic irrigation system is shown below:

Grid View



for **User interface**

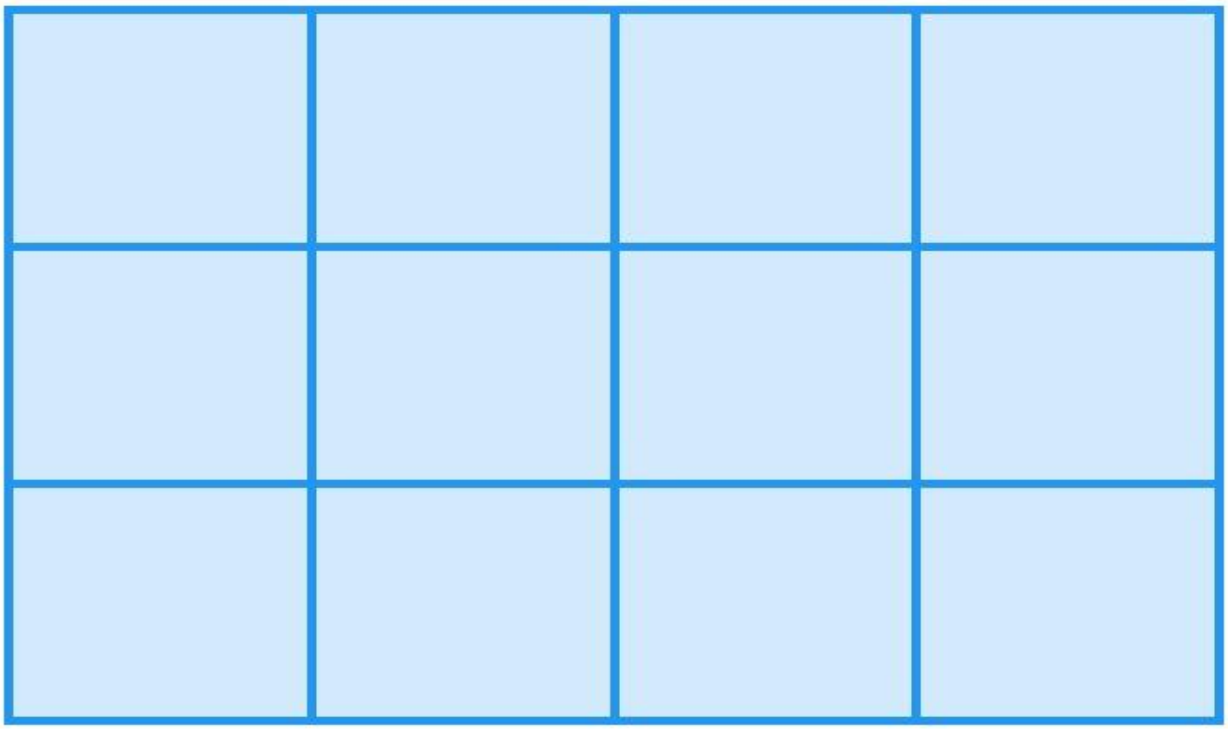
User interface is also necessary for watching over the systems and predicting or resolving any issues. For the user interface, we plan to create a website which shows all the necessary data regarding the system.

It would show data regarding:

1) Moisture content in a specified area
2) Last watered date and time
3) Number of planted trees
4) Possible fire hazard in buildings

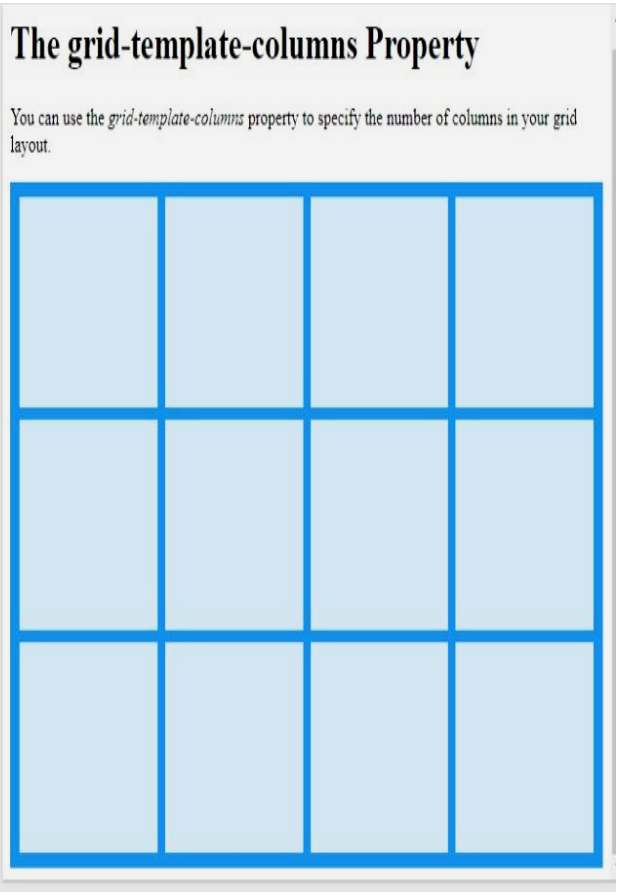
The interface will include 2 layers of data:

First Layer: This layer will be invisible to the user until the colors change. It will consist of a grid which will change the colors of the referenced boxes to show data regarding the field with the help of predefined color scheme.



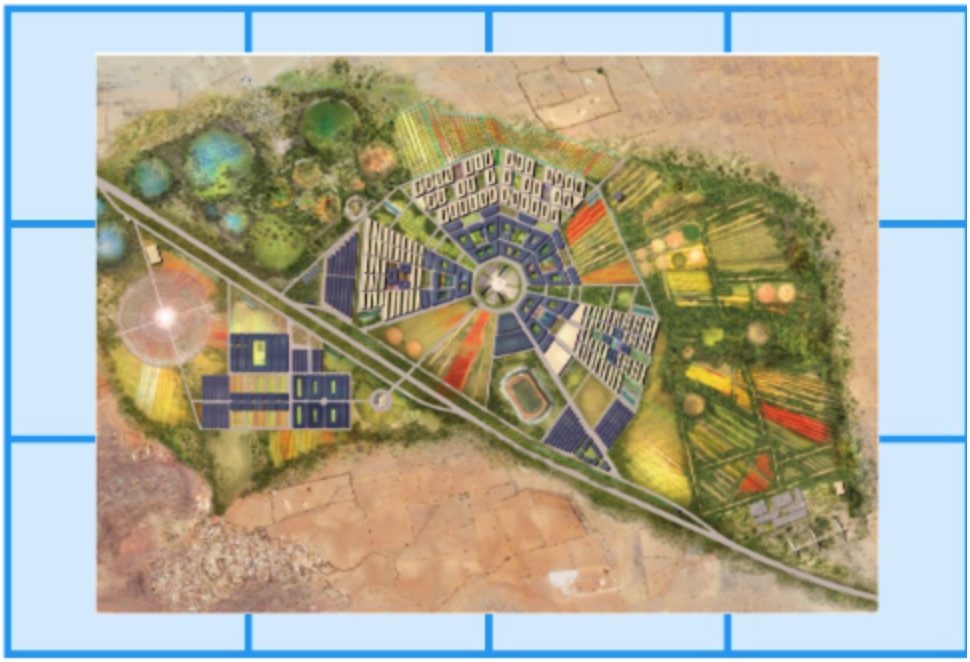
Demo code:

```
<!DOCTYPE html>
<html>
<head>
<style>
.grid-container {
  display: grid;
  grid-template-columns: auto auto auto auto;
  gap: 8px;
  background-color: #2196F3;
  padding: 10px;
}

.grid-container > div {
  background-color: rgba(255, 255, 255, 0.8);
  text-align: center;
  padding: 70px 0;
  font-size: 30px;
}
</style>
</head>
<body>

<h1>The grid-template-columns Property</h1>

<p>You can use the <em>grid-template-columns</em> property to specify the
number of columns in your grid layout.</p>

<div class="grid-container">
  <div></div>
  <div></div>
  <div></div>
  <div></div>
```



Second Layer: This layer will be on top of the first layer and will be responsible for all the understandable data viewing. It will contain a map of the campus layered in such a way that when all the data is shown through the grid, it lights up the respective area on the map.
This will be the interface that the user uses to check up on all the different areas of the campus.

Final result looks like the following image (for reference) without the grid boundaries.



Distribution of workload:

The Idea had been projected by Amey, and inputs given by all of the group members. Abhishek, Avichal researched about the proficiency of the sensors used, whereas Anjali and Abhinav did all the background work on finding the multiple sensors and connecting them using logic gates. Using the help of simulators and browsing the internet, Amey made up the circuit diagram, with the help of group members on browsing and rectifying the connections.

The front end display of the irrigation system was created by Deekshant and Ankit. Abhiroop found/wrote the HTML code used in the irrigation system.

Overall, all of the group members contributed towards the project. All decisions were taken collectively.

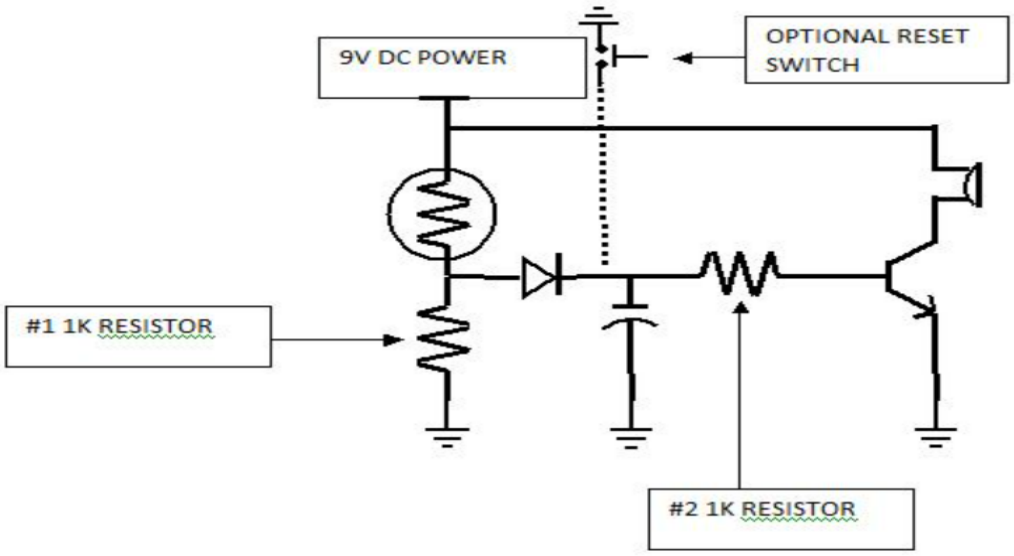
Now, the group proposes to take the plan forward by doing the physical application just according to the theoretical work done by each of the team members. The group plans upon building the prototype the next semester by applying all of the theoretical knowledge which we have procured while undertaking the research on this project.

Collectively, the group got to learn a lot about the circuit connections and the connections of sensors with the GSM modem as well as about various microcontrollers.

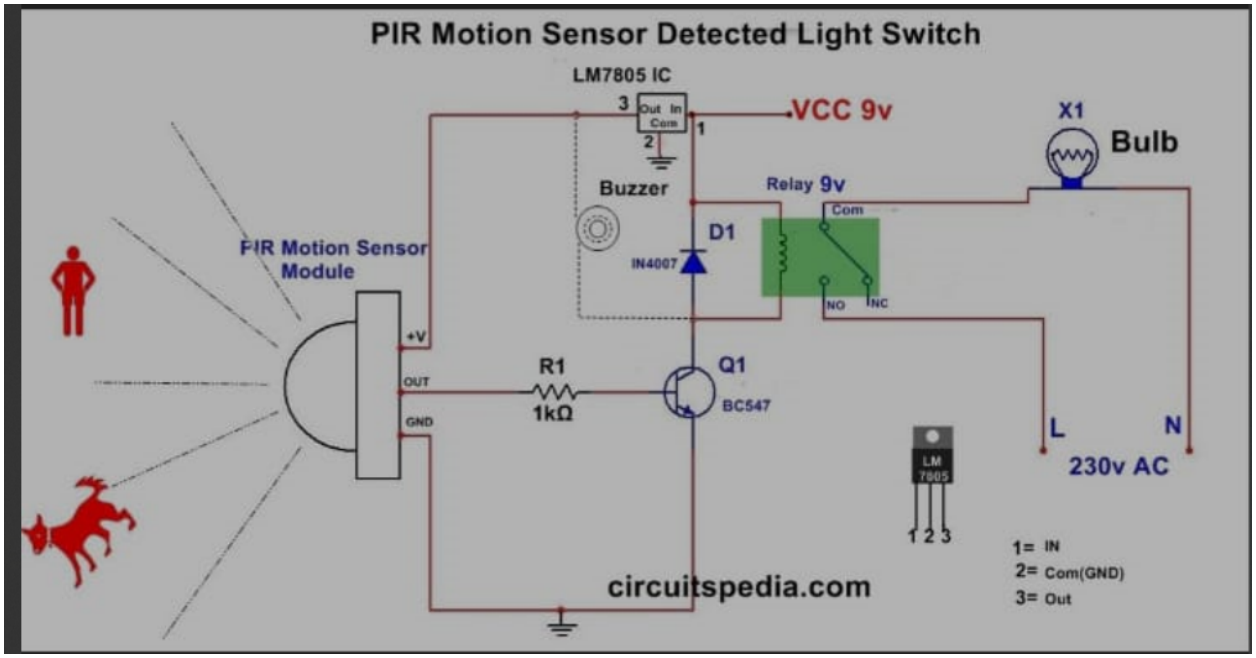
Comparison with other designs/circuits {Pre-existing solutions}

There are several proposed systems using many different sensors for Different purposes. Some of the major models that are popular and satisfy the above mentioned purpose are as follows:

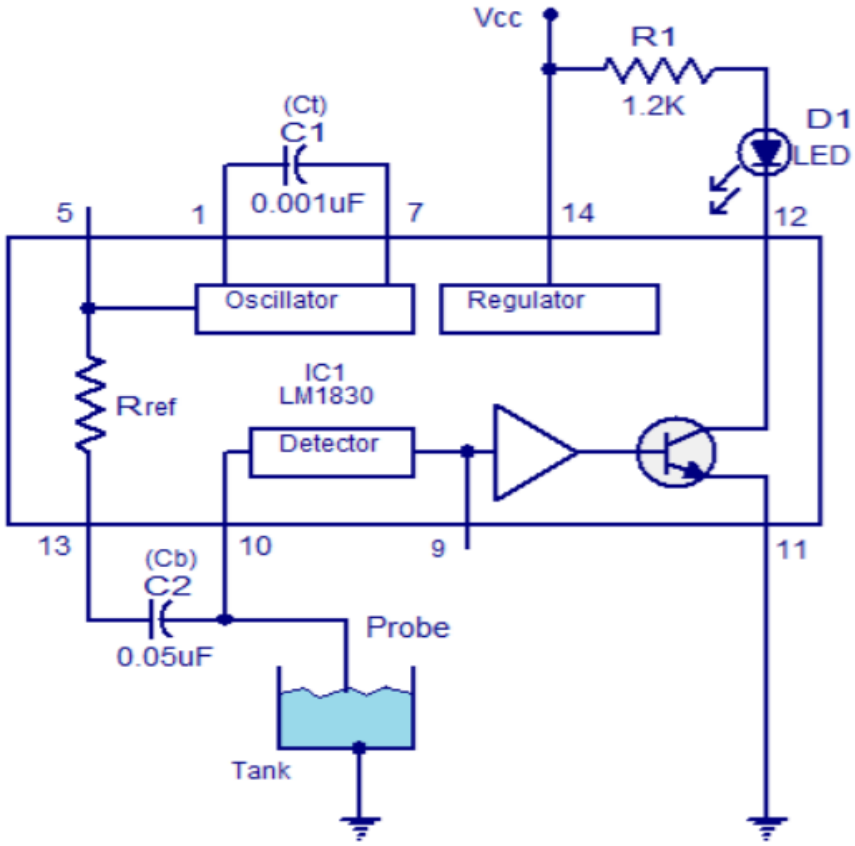
Design 1 will be our preferred design, the other design alternatives are given below.



Design 2 : Common Thermistor based fire alarm system.

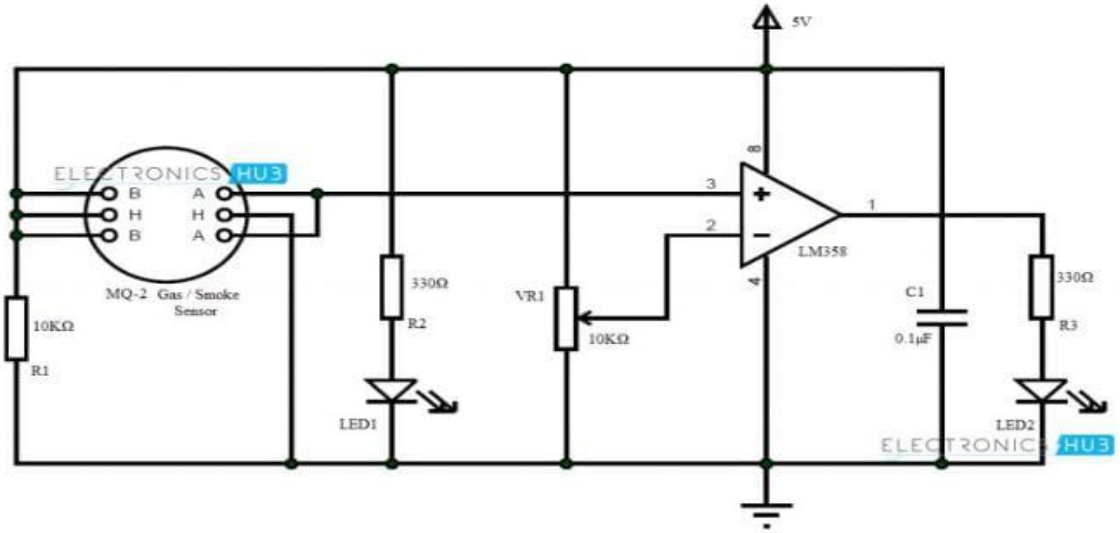


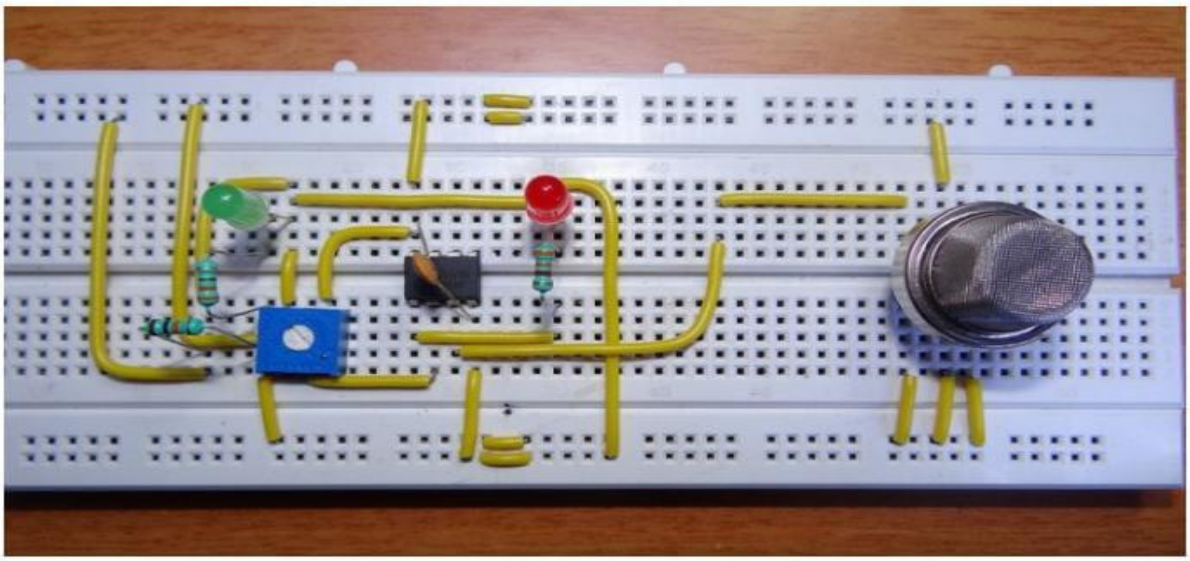
Design 3: PIR based motion detection and automated light system.



Design 4: Moisture sensor based water level measurement system

Circuit Diagram





Design 5: MQ2 smoke sensor based smoke detection system

Decision matrix

	Cost	Time delay	Fault tolerance	Longevity	Range of Alarm	Rank
Weighting Factor	0.1	0.25	0.25	0.25	0.15	1
Design 1	7:-->0.7	9:-->2.25	8.5:--->2.125	6—>1.25	10—>1.5	7.825
Design 2	8:-->0.8	8:-->2	6.5:--->1.625	9—>2.25	4—>0.6	7.275
Design 3	9:-->0.9	8:-->2	5:--->1.25	5—>1.25	2—>0.3	5.7
Design 4	9:-->0.9	7:-->1.75	8:--->2.00	6—>1.5	4—>0.6	6.75
Design 5	8:-->0.8	6:-->1.5	7:--->1.75	8—>2	2—>0.3	6.35

Basis of grading of decision matrix:

Parameter 1: Cost in Rs.

Rs.	**Grading**
500- 1000	9
1000-1500	8
1500-2000	7
2000-2500	6
2500-3000	5
3000-3500	4

The cost being a quite important aspect of any system, Grades are given according to the range of expense invested in the building of the circuit.

Parameter 2: Time delay

The grading is done on the basis of the time taken by the system to detect the problem .
An ideal sensor system would take negligible time to detect the problem so, practically,a good sensor system should take minimum time to detect. Thus,sensor system which takes lesser time is given higher rank.
The time delay varies for various sensor system ranging from a few seconds to minutes.
0 - 10 sec : 9
10-20 sec : 8
20-30 sec : 7
30-40 sec : 6
40-50 sec : 5
50 - 60 sec : 4
More than a minute : 3

Parameter 3: Fault tolerance

For this, in order to achieve a grade greater than 7, the system must be able to adapt or function at multiple locations, like workplaces, residential areas, different terrains, etc.

The ones which have a more location specific application are given a grade (5-7) even if it displays a decent level of versatility. Those which are extensively domain specific are given a lower grade.

Parameter 4: Longevity

This is based on the durability of the circuits. The longer the system stays intact, higher the grade it fetches. Here grading is done on the basis of tentative average lifespan of the detection systems.

0-2 years: 4 more than 12: 10
2-4 years: 5
4-6 years: 6
6-8 years: 7
8-10 years: 8
10-12 years: 9

Parameter 5: Range of alarm

This is based on the public reachability of the output of the design. The ones with only AV are given an average grade(6), and the ones which have a wider range of reachability, or a wider range of network are given a grade above 8, depending upon the speed of signal transmission.

If the range is:

People present in the room(immediate vicinity): 2
People present in the building(second immediate vicinity): 4
Invested/responsible people in the vicinity(ex: larger chunk of area): 6
People(interested) in city/village : 8
Can be sent to anywhere: 10

Annexure 1

Contribution of Members:

1. Abhiroop Bhavsar(B22ME002):
    - As part of my contribution, I designed the user interface grids for the frontend.
    - I researched about the languages which best suit and fulfill our requirements, and ended up with using HTML and CSS for designing our frontend page.
    - The code for the grid was written by me using HTML and CSS language.
    - I learned the CSS language for making a more efficient and appealing frontend.
    - I understand the project requirement and objective, and then implement on this project

- I continuously updated and improved the code as needed to meet the changing requirements of the project, and finally designed and implemented the code as required by the team.
- Test the code thoroughly to ensure it works as expected.

2. Amey Chhaya (B22BB006):

- I came up with the idea of such a communication/irrigation system.
- I researched about the circuits, and did some background work on sensor based circuits, especially about various detectors.
- I finalized the circuit connection of both the Fire alarm(our previous project) as well as the Irrigation system.
- The passing parameters of the decision matrix were selected by me and I also did research to quantify our grading system.
- I also made all the presentations as well as a large chunk of the report.
- In the next semester, I did my best to make an efficient working connection with this system.
- I also started to learn about arduino and other microprocessors, and took that further in the next semester.

3. Anjali Sharma (B22PH002):

- I researched about the sensors to be used in our design.
- Majorly focusing on the fire alarm system, I did the background research on the fire, smoke, and temperature sensors keeping in mind the project requirements, cost, efficiency, reliability, and availability . Thus, choosing sensors best suited for our project design. Then, when it came to the irrigation system, I finalized the materials being used.
- I also helped in selecting the passing parameters and grading by comparing the various sensors and circuit designs.
- This project helped me a lot in learning about various sensors and sensor systems, their working, and many technical and functional details.

- In the next semester, I took this as a great opportunity to apply these learnings in making a practically working sensor system.

4. Ankit Shaw (B22EE009):

- As part of my contribution, In beginning I gave some idea (eg. foldable furniture system).
- I also helped in eliminating topics.We then finalise the “Sensor Based Communication System”.
- I also schedule our ED meet.
- I came up with one circuit design.
- I also helped my teammates in making the decision matrix.
- In the next semester, I helped my teammates in making a practically working sensor system.

5. Abhinav Gupta (B22CS002):

- I worked on the sensor to be incorporated in our project. I specifically focused on the GSM type sensor.
- I studied about the various components used in making a sensor, and decided on what type of sensor would be the best for our project.
- I worked on the finances of our project. I made an exhaustive list of components required and their approximate cost.
- I helped in the research for the matrix component of our project.
- From this course, I learned how to think creatively and how to work in a team.
- Next semester, I had the opportunity to realize our project along with my teammates.

6. Abhishek Yadav (B22MT002):

- As per my contribution,I have suggested the group name.
- I helped my teammates in ppt editing.
- I have done the background research about the sensor.
- I helped in finding component of the project at minimal cost.
- I also help my fellow team members with their research

and problem solving.

7. Avichal Sinha (B22CH004):

- Regarding my contribution I researched about the proficiency of the different sensors used in the project
- I have done the rating of sensor sensitivity in decision matrix with my teammates.
- I have made the introduction part of the report .
- In the next semester I will help my teammates in making the project prototype.

8. Deekshant Singh Rajawat (B22CI010):

- Regarding my contribution I made the program for the front end on the website and the code behind the working of the website including the gps and grid oriented system.
- I incorporated the grid idea in the project.
- I helped in researching the components used in the various parts of the project.
- In the next semester I completed the code and increased the efficiency of the current method used in the project. As well as helped run the mechanical parts of our project.