HYDROSURE

TEAM MEMBERS:

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Abstract:

The objective of the project is to develop a moisture sensing and temperature sensing cum watering system for irrigation. This system will combine cutting-edge hardware and software technologies to enhance the effectiveness of irrigation practices. The core objective is to create a system that can accurately measure the moisture content in a given soil sample and sense the temperature conditions at a given time. We then integrate those values effectively depending on the crop type to decide upon the adequate amount of water needed by the crop in the pertaining conditions. Conclusively, the circuit is a blend of moisture and temperature sensations aided by the type of crop in use to develop an efficient and sustainable system to monitor the sufficiency of water. The system will incorporate automated irrigation capabilities, ensuring crops receive the right amount of water at the right time.

Agriculture forms the cornerstone of the economy, serving as its foundational pillar. The project recognizes the global challenges of water scarcity and climate change, which underscore the urgency of adopting efficient irrigation techniques. The project emphasizes the importance of technology driven solutions in modern agriculture to meet the growing global demand for food. The project underscores the importance of responsible environmental stewardship. By reducing the environmental footprint of agriculture, it aligns with global efforts to protect ecosystems and biodiversity.

We are designing and implement advanced algorithms to process the sensor data efficiently, providing real-time insights into soil moisture levels. Additionally, we are developing predictive models to optimize irrigation strategies, ensuring precise water delivery for maximum crop yields. Our experience in integrating hardware and software solutions will be instrumental in creating a seamless and user-friendly interface for farmers. Ultimately, our skills will play a vital role in harnessing the power of technology to enhance the project's overall effectiveness and impact.

DESCRIPTION

The module consists of a moisture sensor, temperature sensor, priority encoders, 3-bit binary adder, magnitude comparator and a crop value counter. The working begins with collecting inputs from the moisture and temperature sensors. The crop value counter sets the type of crop which is to be irrigated. The rest of the components are utilised to manipulate and blend the input to perform the functionality of setting an optimal threshold and deciding the amount of water needed.

MOISTURE SENSOR:

A capacitive moisture sensor has been used which measures the moisture content in a given soil sample. The moisture sensor has been coupled with an Arduino device. The output of the moisture sensor is in the range of 0-100.The Arduino code written enables us to manipulate the sensed value such that it gives 0 if the sensed value is in the range 0-10,1 if the sensed value is in the range 11-20 and so on.

TEMPERATURE SENSOR:

A capacitive temperature sensor has been employed which measures the temperature conditions of the atmosphere at the instant. It is also coupled with an Arduino device. The range of values is 0-100 but practically speaking it is just in very extreme conditions that the temperature exceeds 50. So, the Arduino code is written to map the sensed values as 0 in the range 0-10,1 in the range 11-20 and so on till 4 in the range 41-50.

CROP TYPE SELECTOR:

We have deployed a predefined menu to select the type of crop in use. For, the sake of the project prototype we have listed down a few crops in the order of the increasing amount of water they need. Each of them is given a decimal number as reference in the order of their requirement of water. We have selected rice, wheat, maize, bean and sugarcane as prototypes. Each of the crops is given a value as shown in the table below depending on their optimal moisture requirement. Sugarcane is given a value 4 which implies it has the highest water requirement from amongst the selected, conversely bean is given a value 0 implying it has the least water requirement. The selection of the crop has been implemented using a synchronous 3-bit up-down counter circuit counting from 0 to 4 giving the output in binary format.

BEAN	0
WHEAT	1
MAIZE	2
RICE	3
SUGARCANE	4

PRIORITY ENCODERS:

The values given by the moisture sensor and temperature sensors is passed into priority encoders to convert them to binary form. The value from the moisture sensor is fed into a 4-bit priority encoder and the value from the temperature sensor is passed into a 3-bit priority encoder.

4-BIT BINARY ADDER:

This component's functionality is to set an optimal threshold value for the moisture content needed depending on the crop type and the input from the temperature sensor modified using a 3-bit priority encoder. The binary values from the 3-bit priority encoder and the crop type selector are fed in as inputs with a 0 appended to them to make them as 4-bit inputs. The output of this 4-bit binary adder gives us with a reasonable threshold for the moisture content that is required in the existing conditions.

4-BIT MAGNITUDE COMPARATOR:

This component compares the output of the 4-bit binary adder with the value given by the moisture sensor encoded to binary using a 4 bit priority encoder.

It gives three outputs after comparing the given values. Now, we water the crop only if the value from the moisture sensor is less or equal to the threshold value. The following actions are undertaken depending on the output of the magnitude comparator assuming a and b are inputs given to it.

Outcome	ACTION
a<b	The crop is watered.
a=b	The crop is watered.
a>b	No watering is carried out

WORKING OF THE MODULE:

The major functionality of the module is dependent on the following:

1.The Crop type selector.

2.Encoding the output from the sensors.

3.Setting the threshold using the 4-bit binary adder.

4.Comparing the values using the magnitude comparator.

SETTING THE THRESHOLD:

This is carried out by the 4-bit binary adder using the outputs from the crop type selector and the temperature sensor as inputs according to the following functional tables:

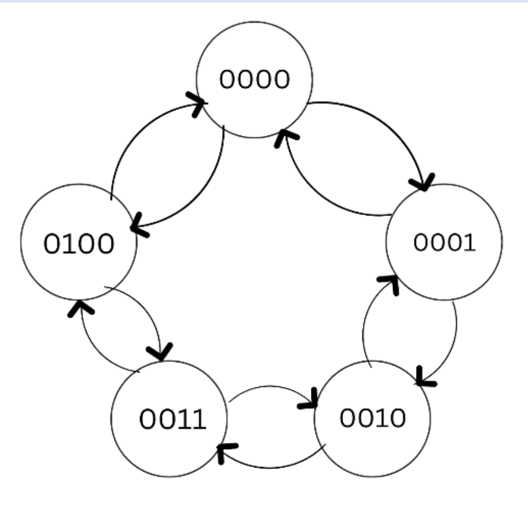
CROP TYPE	VALUE GENERATED BY THE PRIORITY ENCODER (TEMPERATURE SENSOR)	THRESHOLD VALUE
SUGARCANE(4) 0100	0-0000	0100
	1-0001	0101
	2-0010	0110
	3-0011	0111
	4-0100	1000
RICE (3) 0011	0-0000	0011
	1-0001	0100
	2-0010	0101
	3-0011	0110
	4-0100	0111
MAIZE (2) 0010	0-0000	0010
	1-0001	0011
	2-0010	0100
	3-0011	0101
	4-0100	0110

WHEAT (1) 0001	0-0000	0001
	1-0001	0010
	2-0010	0011
	3-0011	0100
	4-0100	0101
BEAN (0) 0000	0-0000	0000
	1-0001	0001
	2-0010	0010
	3-0011	0011
	4-0100	0100

CROP TYPE SELECTOR:

The crop type selector uses synchronous 3-bit up down circuit, counting numbers from 0 to 4 since the prototype has 4 types of crops. This circuit consists of 3 T flip-flops in the sequential circuit segment and comprises of combination of AND & OR gates in combinational part. It uses LED display to the output in binary form (7- segment display can also be used). It uses a pushbutton to navigate through inputs. Reverser button is used to change the direction of navigation (ascending (0) / descending (1)). The upper limit of the crop is 4 and returns back to 0 on further push up (vice-versa if direction is reversed).

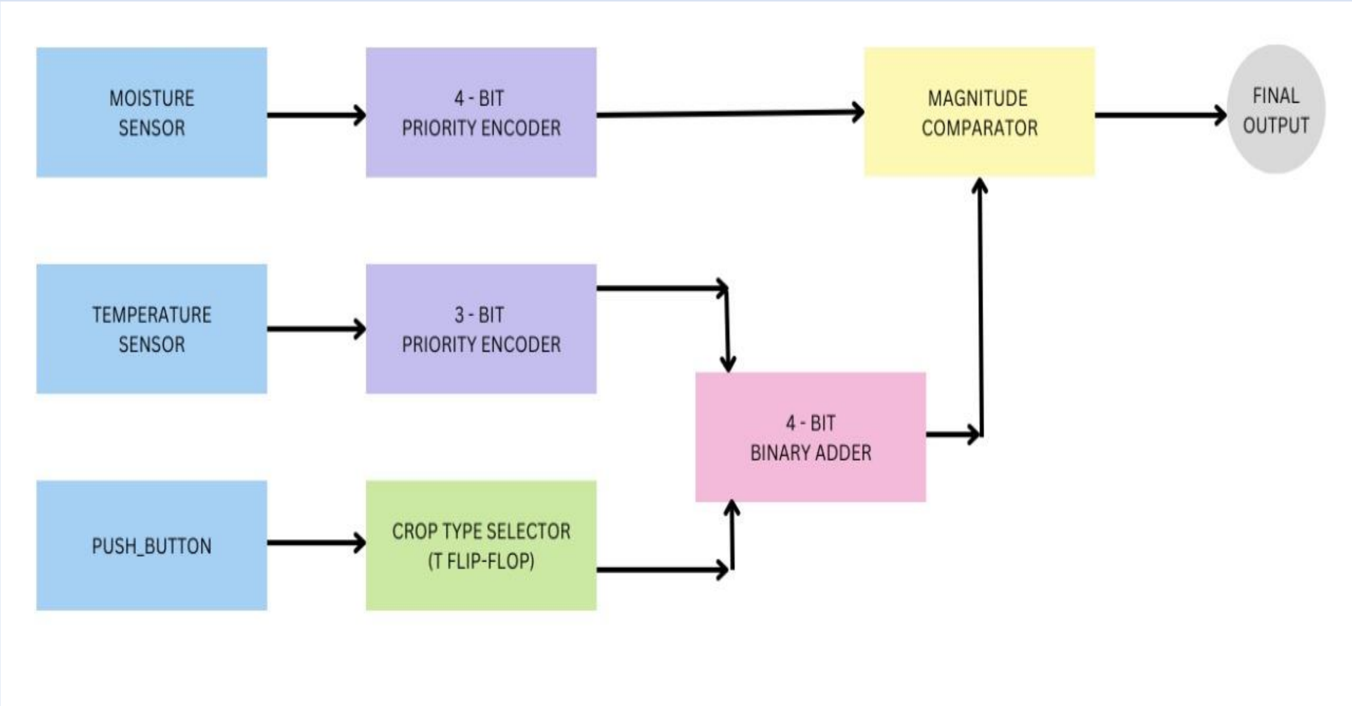
TRANSITION DIAGRAM:



Excitation Table:

M	Q3	Q2	Q3	Q3’	Q2’	Q1’	T3	T2	T1
0	0	0	0	0	0	1	0	0	1
0	0	0	1	0	1	0	0	1	1
0	0	1	0	0	1	1	0	0	1
0	0	1	1	1	0	0	1	1	1
0	1	0	0	0	0	0	1	0	0
1	0	0	0	1	0	0	1	0	0
1	0	0	1	0	0	0	0	0	1
1	0	1	0	0	0	1	0	1	1
1	0	1	1	0	1	0	0	0	1
1	1	0	0	0	1	1	1	1	1

FLOWCHART:



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