I have created a system requirement towards completion of every project requirement below.

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|  | Objectives | System Requirement | Notes |
| (a) Moisture Level | - Measures soil moisture and transmits real-time information about soil moisture using GSM modem form a variety of locations within the portion of land to administrator for analysis. | The system must be set to transmit all the data acquired every 30 minutes by default, adjustible to 6 Hour intervals. 1m, 2m, 5m, 10m, 15m, 20m, 30m, 1h, 2h, 2.5h, 3.5h, 4h, 4.5h, 5h, 5.5h, 6h.  The system is required to read from it sensors every 30 minutes by default adjustible to 1,2,5,10,15,20 minute intervals by set remotely by the the administrator  The system will transmit its configuration data at the will of the administrator, and on completion of any changes it was requested to make | The communication modules system will implement parity and flow control  The read intervals and data transmit intervals are to be independent of one another  Data select MUX  Message module |
| - Capable of allowing setting of optimum moisture level for different crops. | The system will store three thresholds compare. The optimum threshold; the dry threshold and the flooded threshold. Flood warning will be issued by the system when the acquired moisture level is above the flood threshold |  |
|  |
| - If moisture level below the min threshold required then an irrigation system turned on for that portion of land and kept on until optimum moisture level reached. | The system will start irrigation if the water falls below the Dry threshold.  The system will have a variable irrigation timer. This will the system to switch off automatically after the administrator action is taken.  Automatic irrigation feature remains off by default, irrigation timer will be variable; 2m, 5m, 10m, 15m, 20m, 30m on by default with lowest time setting. The system will pre-empt an irrigation session when the moisture level rises above the optimum.  A percolation delay timer will be implemented to allow water to percolate. This is to prevent valves from being reopened for a refractory period after an irrigation session times out | Water takes time to percolate through soil. Depending on the irrigation system employed and the soil type, we may end up with a situation where where the soil may become water logged before the system pre-empts irrigation |
| (b) PH Level | - Measures soil PH and transmits real-time information about soil PH using GSM modem from a variety of locations within the portion of land to administrator for analysis. | pH and moisture will be transmitted in the same session |  |
| - Capable of allowing setting of optimum PH level for different crops. | The system will allow the administrator to set two pH threshold levels; Upper and lower. |  |
| - If PH level not appropriate then warning messages to be send to administrator using GSM modem. | The system will compare the last reading with the current thresholds |  |
| (c) Graphical User Interface | - for displaying all messages, warning and information sent by agricultural maintenance terminals in the fields |  |  |
|  | - for control of switches, actuators, etc which resolve PH and moisture issues |  |  |
| (d) System portable and capable of being powered via batteries or the 12V outlet of a vehicl |  |  |  |

Division of requirements among modules.  
Here I have divided the requirements into indivisible functions to be performed by a module.  
1 function maps to 1 module

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| --- | --- | --- |
| System Requirement | Functions | Modules |
| 1)The system must be set to transmit all the data acquired every 30 minutes by default, adjustible to 6 Hour intervals. 1m, 2m, 5m, 10m, 15m, 20m, 30m, 1h, 2h, 2.5h, 3.5h, 4h, 4.5h, 5h, 5.5h, 6h. | 1)Transmission of data on administrator-determined time intervals  Time keeping | Transmit Timer Module  UART Transmit Module  Message Driver |
| 2)The system is required to read from it sensors every 30 minutes by default adjustible to 1,2,5,10,15,20 minute intervals by set remotely by the the administrator | 1.) Sampling of data on administrator determined time intervals. | ADC Read module |
| 2)Conversion of analogue signals to raw binary | ADC (analoge side) |
| 3) translation of binary to unit specific values in binary | pH LUT, Moisture LUT |
| 4)storage of raw binary data | Sensor data module |
| 3)The system will transmit its configuration data at the will of the administrator, and on completion of any changes it was requested to make | Remote storage and modification of configuration data | UART Receive module  UART Transmit module  UART Flow control module |
| 4)The system will store three thresholds compare. The optimum threshold; the dry threshold and the flooded threshold. Flood warning will be issued by the system when the acquired moisture level is above the flood threshold | Comparing stored binary data, | Sensor data Module  Moisture Comparator module |
| The system will start irrigation if the water falls below the Dry threshold.  Warning should be issued once | Comparing data and signalling | Sensor data Module  Moisture Comparator module |
| The system will have a variable irrigation timer. This will the system reclose valves automatically after the administrator action is taken. | Time keeping, data storage of settings, translation data to a time interval | Configuration Storage Module  Irrigation Timer  Timer LUT |
| Automatic irrigation feature remains off by default, irrigation timer will be variable; 2m, 5m, 10m, 15m, 20m, 30m on by default with lowest time setting. The system will pre-empt an irrigation session when the moisture level rises above the optimum. | Time keeping, data storage of settings, translation data to a time interval | Configuration Storage Module  Automatic irrigation timer |
| A percolation delay timer will delay the system to allow water to percolate. This will to prevent valves from being reopened for a refractory period after an irrigation session times out | Time keeping, data storage of settings, translation data to a time interval | Configuration Storage Module  Timer LUT  Percolation |
| pH and moisture will be transmitted in the same session | communication | UART transmit module |
| The system will allow the administrator to set two pH threshold levels; Upper and lower. | Storing and modifying data | UART Receive module, |
| The system will compare the last reading with the current pH thresholds | Comparing data | Comparators |



The Timer modules will have their respective LUT’s

The configuration data will have all zeros at rest state, the look up tables of the timers will map 0000 to the respective default states

UART messages will set respective timers to their values by changing configuration registers in the configuration storage modules

The message driver will coordinate access data access to the transmit timer by controlling the data select multiplexer and respond to request commands form Receive UART

The UART flow control module coordinate flow control according to RS232 standards

The comparator will compare raw bit data

Setting threshold will require two bytes of data:   
one to address the correct threshold register and the other with the threshold data. The UART RX timer aborts causes the sensor data module to abort the threshold change on timeout