WATER MANAGEMENT SURVEY REPORT

Introduction

Water is a natural resource, fundamental to life, livelihood, food security and sustainable development. It is also a scarce resource. As it is scarce the need of designing policies which enables the practice of constraint use of water is much required.

Much effort in water resource management is directed at optimizing the use of water and in minimizing the impact of water use on the natural environment.

Successful management of any resources requires accurate knowledge of the resource available, the uses to which it may be put, the competing demands for the resource, measures to and processes to evaluate the significance and worth of competing demands and mechanisms to translate policy decisions into actions on the ground.
With our research and resources we worked out on a solution for the region where a huge quantity is wasted which results also in product loss. Thus typical region is paddy manufacturing. Paddy manufacturing requires water regularly and also at very accurate quantity. Selecting this region to implement water management we can increase production and save water.

India has the largest paddy output in the world and is also the fourth largest exporter of rice in the world. Paddy fields are a common sight throughout India, both in the Northern Gangetic plains and the southern peninsular plateaus. Paddy is cultivated at least twice a year in most parts of India, the two seasons being known as Rabi and Kharif respectively. The former cultivation is dependent on irrigation, while the latter depends on Monsoon. The paddy cultivation plays a major role in the socio-cultural life of rural India. Water is essential to rice cultivation. Adequate water supply is one of the most important factors in rice production. A recent study conducted by the International Water Management Institute (IWMI), estimates that by the year 2020 a third of the Asian population will face water shortages. The next wars may be fought over water (Gleick, 1993). The growth rate in the development of irrigation has already declined (Barker et al. 1998).

In Andhra Pradesh & Telangana states, the cultivation is totally depending upon electric motors, ponds & reservoirs. If we come across the cultivation of paddy crop with ponds & reservoirs, the water management is not in proper manner. More amount of water is wasting due to lack of knowledge on water resources .In the state of Andhra Pradesh, the water from ponds directly goes to the fields if we open the gates, from one field to the other field in a step by step manner. After filling the all the fields the water, the water overflows from the field and wasting out. So we want to design a Smart Embedded solution for the paddy crop system. In this, we are going to use the level sensor & a gate in each field. Suppose if we are having 6-blocks area. We are going to keep 6-level sensors & gates in each area. If the water in anyone area comes a threshold level of the level sensor, it passes the information to the microcontroller then controller automatically blocks the passage of water to that area. In the same way, this continues for all areas. If all areas block its passage of water then only the central gate will closev & information will be passed to the farmer through GSM. So, In this way, we can restrict the wastage of water.

In light of the bigger project to improve water management in paddy fields through engineering advancements, a survey was conducted in Water and Land Management Training and Research Institute (WALAMTARI).

Main body

During the survey, different paddy crops were thoroughly examined. Statistical data regarding their growth, irrigation requirements were obtained. Different possibilities of supplementing water irrigation through motors were examined.

The area under irrigated paddy went down from 81.23 per cent of the gross irrigated area in 1956-57 to 63.05 per cent in 2008-09 . In aggregate terms, the area under irrigated paddy went up marginally from 3.83 m. ha in 1990-91 to 4.25 m. ha in 2008-09, a 10% growth over two decades, while the total irrigated area in the state increased from 5.37 m. Ha in 1990-91 to 6.74 m. ha in 2008-09. Even here, the irrigated paddy area in 2007-08 was almost the same as that of 1990-91, while the state experienced a quantum jump in irrigation during these two decades (by nearly 9.15lac hectares). Now it is unlikely that the area under canal-irrigated paddy had reduced over time in the state as it is generally observed that farmer receiving canal water take up wet crops. Hence it is unlikely that area under well-irrigated paddy went up over time. On the other hand, the degree of groundwater utilization went up from 28 per cent to 45% (Jain, 2008), which indicate a lack of connection between paddy irrigation and groundwater depletion. Still, academic and policy debates on sustaining Andhra Pradesh's groundwater irrigation economy had to a great extent centered on reducing the area under well-irrigated paddy.

Table 1. Water requirement of rice crop at different growth stages

Stages of growth	**Avg. water requirement (mm)**	**% of total water requirement (approx.)**
Nursery	50-60	5
Main field preparation	200-250	20
Planting to Panicle initiation (PI)	400-550	4
P.I to flowering	400-450	30
Flowering to maturity	100-150	5
Total	**1200-1460**	**100.0**

Table 2. Irrigation schedule of the paddy (rice).

Short Duration variety		**Medium Duration variety**		**Long Duration variety**	
Days	**Water level (cm)**	**Days**	**Water level (cm)**	**Days**	**Water level (cm)**
1-25	2-3	1-30	2-3	1-35	2-3
25	Thin film of water	30	Thin film of water	35	Thin film of water
28	Life irrigation	33	Life irrigatio n	38	Life irrigation
29-50	2-5	34-65	2-5	39-90 or 95	2-5
51-70	2-5	66-95	2-5	96-125	2-5
71-105	2-5	96-125	2-5	126-150	2-5

Note: Stop irrigation 10 days before harvest Number of irrigation may be decided depending upon the receipt of rain and available moisture content.

Paddy crop is strongly influenced by water supply. Water should be kept standing in the field throughout the growth period. In water scarcity areas, the saturated soil in a chemical reduced stage is desirable. The characteristics of flooded soil which are conducive to high yields are: (i) greater availability of nutrients such as phosphorus, iron, and manganese, (ii) suppression of weed competition, (iii) elimination of moisture stress as a limiting factor, (iv) Micro-climate favorable to crop production.

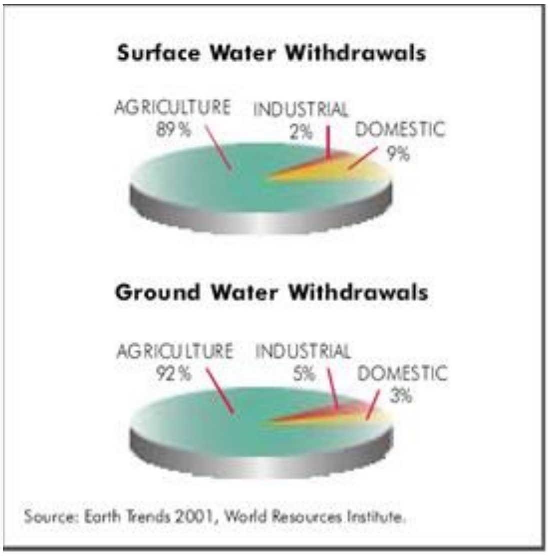
Excess / limited / no water leads to a reduction in yield.
Rice a semi - aquatic plant requires near submergence
Submergence helps in - suppressing weed growth and more availability of certain nutrients.
Total water requirement of rice is 1200 - 1400 mm
2000 - 3000 liters of water required to produce 1kg of rice.
Maintenance of water depths in the field as recommended for high water use efficiency and yield.
Summer plowing minimizes water requirement for land preparation.

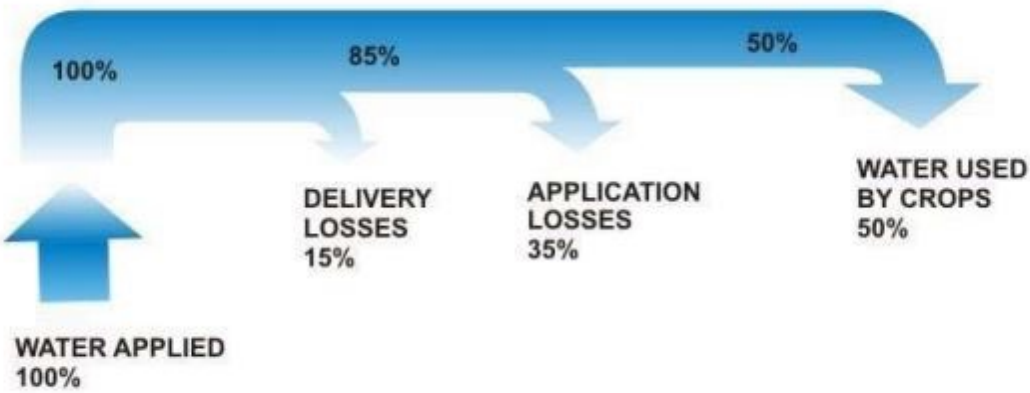
From the survey in general 50mm of continuous water level should be maintained in the paddy field for high yield

Draining of water after 5-7 days repeatedly helps to remove the toxic substances like sulfides and regulates oxygen supply to roots.

Irrigation schedule for rice under limited water resources

For summer rice under limited resources of water, phasic stress irrigation can be practiced to the advantage of saving a substantial quantity of irrigation water without any significant reduction in yield. About 20-30% more area can be irrigated with the same water resources by adopting any of the following phasic stress irrigation schedules as given in the following table. Depending up on the schedule, water saving ranges from 24-36% of the requirement for 5 cm continuous submergence throughout the crop growth. Grain yield reduction in the above practice is only 0.1% to 1.6%.





World's water systems face formidable threats. More than a billion people currently live in water-scarce regions, and as many as 3.5 billion could experience water scarcity by 2025. Increasing pollution degrades freshwater and coastal aquatic ecosystems.
India's water crisis is rooted in three causes. The first is insufficient water per person as a result of population growth. The total amount of usable water has been estimated to be between 700 to 1,200 billion cubic meters (cm). With a population of 1.2 billion according to the 2011 census, India has only 1,000 cubic meters of water per person, even using the higher estimate. A country is considered water-stressed if it has less than 1,700 cubic meters per person per year.

Solution

As per the survey, the water from canals is being used for paddy cultivation in many coastal areas. Here the supply of water is not mentored and monitored by any, this is amplifying the copious loss of water. Water management is achievable in this synopsis using a smart embedded solution.

Keeping the entire scenario under our platform we designed an unconventional solution based on the availability of technology that is adaptable and scalable in terms of efficiency and productivity.

This solution is entirely built on fundamentals and concepts of the Internet of Things with zero configuration. This solution includes many modern technologies and it can be interfaced with the technologies (products) used by farmers.

The basic idea of the solution is to design a Smart Embedded solution for the paddy crop system. In this, we are going to use the level sensor & a gate in each field. Suppose if we are having 6-blocks area. We are going to keep 6-level sensors & gates in each area. If the water in anyone area comes a threshold level of the level sensor, it passes the information to the microcontroller then controller automatically blocks the passage of water to that area. In the same way, this continues for all areas. If all areas block its passage of water then only the central gate will be closed & information will be passed to the farmer through GSM. So, in this way we can restrict the wastage of water.

Technically, the above-mentioned sensors are the data points and data acquisition is done using Arduino. This streamed data is processed and then actions are triggered based on the requirements. Here, we are including a real-time clock (RTC) which sets the entire module in harmony.

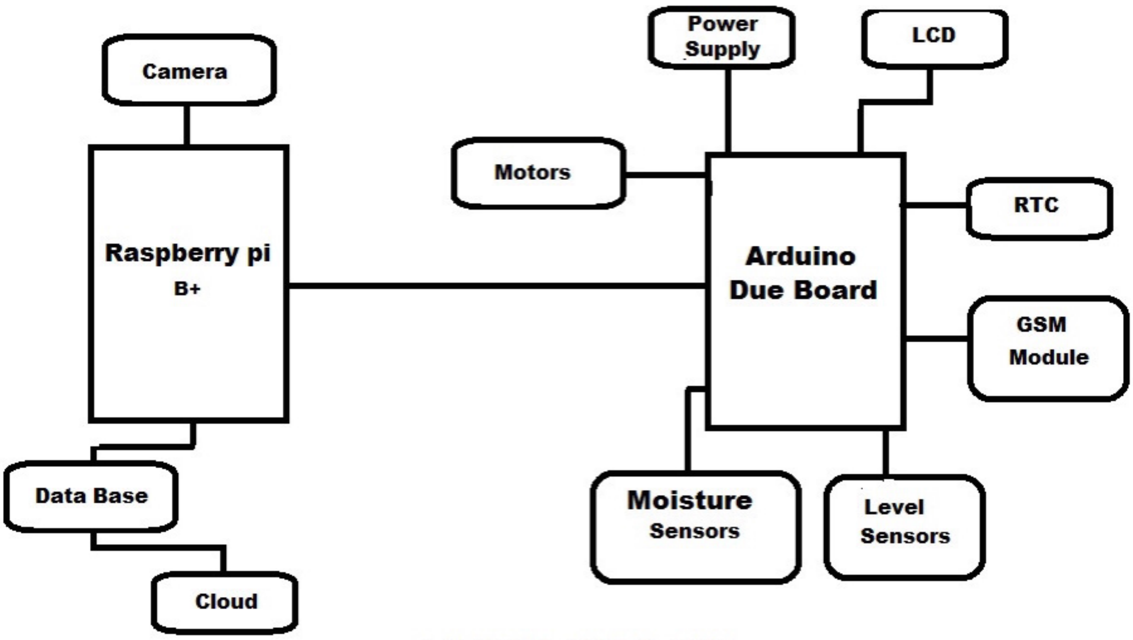
As we know (based on the survey), the requirement of water for paddy cultivation is different at different periods over, to perform an action based on this period the unique capability of RTC comes into play. And that capability is to automate system in real time based on the requirements.

This data from all these data points is streamed to our central processing unit, Raspberry Pi. The data is stored in an SQL Database hosted on Raspberry Pi. This data is queried to find a meaningful pattern and then these patterns are used as a primary reference to plan the future in terms of economy and infrastructure.

A small camera is also been used to collect images at times and then stored. These images are processed to calculate. This calculation will help up develop completely new and revolutionary methods to trigger actions.

Considering all the atmospheric parameters that influence the productivity of paddy cultivation we can extend our solution. Here, every atmospheric parameter is sensed using a unique sensor and every sensor is our new data point.

Below we have a block diagram visualizing the entire architecture of the solution.



BLOCK DIAGRAM

References

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