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Dynamic Drip Irrigation with Limited Water Resource in Musa Acuminata Farm Cultivation

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ABSTRACT

Musa Acuminata is considered is most important tropical fruit. Musa Acuminatas can be cultivated on a wide variety of soils, when they are fertilized and well-drained. The most suitable soil are deep, and well-drained with a good water containing capacity. Musa acuminata is a heavy feeder crop/. Therefore, fertility of soil is very important. Rich, well drained, fertile, free working, soils with plenty of organic matter are best suited for cultivation. The optimum range of pH of soil should be 6 to 8. Total water necessity for a musa acuminata plant is 900-1200mm. It is very difficult to maintain the moisture at all stages of the plant growth. To increase the productivity, excess watering should be avoided and in the same time proper water requirement should be addresses. There are a place of wireless devices called wireless nodes, which dynamically connect and also transfer information. Wireless nodes are personal computers with wireless local area network cards, or any other types of wireless devices or mobile communication devices. Because of this dynamic topology of Mobile Ad hoc Networks can be used anywhere. Out of which the selfish node problem is very seriously considered. The proposed method will effectively address the issue of the irrigation of the musa acuminata farms dynamically based on the water moisture level on the soil. In this approach, the mobile nodes fitted with soil moisture sensors. The mobile node continuously read the sensor and if moisture level is low, mobile node behaves as a selfish node. Each row in the musa acuminata farm will be implemented with mobile nodes based of the sensor capacity. The mobile nodes periodically broadcast a message regularly. So that the nodes which is in the low soil moisture zone will drop the packet and behave selfish The next hop node, will not able to receive the packet and will wait for a time period and uses the selfish node detection algorithms to identify the selfish node and communicate to the other nodes. Then all the cooperative nodes will form a Triangular Cooperative Region (TCORP) and trigger the dripper to irrigate the entire region.

Keywords: Musa Acuminata, range of pH, sensor capacity, selfish node.

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INTRODUCTION

Musa acuminata is a heavy feeder and responds well to manuring. Musa acuminata is a quick growing and short-lived plant. Therefore, it is more beneficial, if quick growing fertilizers are applied. In Tamil Nadu, application of 100 g of N, 30 g of P_2O_5 and 300 g of K_2O per plant to be supplied in three doses during the second, third and fifth months is recommended. In Maharashtra, 100 g N, 40 g P_2O_5 and 100 g K_2O per plant is recommended. Out of these, P_2O_5 and K_2O is applied at the time of planting and N is given is three split doses: third, fourth and fifth month after planting. When water wealth cannot meet the irrigation water requirement, how to manage according to the crop based irrigation time, increasing benefit of the inadequate water supply, is a most vital problem for agricultural sustainable progress. The concept of dynamic irrigation low limit was put forward.[1] The dynamic irrigation low limit is connected with crop growth time and water supply required. When the water supply is minimum the irrigation low limit should be reduced in order to make use of limited water supply in the drier later crop growth stage. Based on the soil moisture available at the main root zone ahead of irrigation is considered. The Remotely Piloted Aircraft thermal imagery, collected as the UAV traverses overhead of a crop, to monitor channel irrigation improvement of large areas of a field. An algorithm for overhead thermal imagery of a field with elevated canopy closure A experimental flight with a weight less than 2kg multirotor UAV was assessed, it was created that at lower sensing altitude (20 m), the majority of the water front's were detected[2]. The irrigation regulator is the "brain" of a whole irrigation method. It controls the flow of water and fertilizer to the plants which enables the farmer a successful crop by using a most selected amount of water and fertilizer [12]. Mobile Ad-hoc Network (MANET) is a paradigm in a wireless revolution in terms of acceptability. Realization of healthy security architecture is not possible without appropriate coordination and trust between the nodes. The applications of MANET for support of agriculture are considered in the proposed paper. The open MANET is the one where various nodes with different goals from a network. So there is a lot of chance for the nodes to act as selfish because of the low energy and resources available for the mobile nodes. Hence to save the energy the nodes decide to non-cooperate with other nodes. Most of the research works try to find the selfish node and avoid the route through that node. Most of the algorithm leaves the selfish node as such and prevent route to the selfish node. In the proposed paper, selfish node problem is used as an application for optimization of the irrigation in the musa acuminata farm. These research works try to utilize the effects of a selfish node in the network, for the benefit of the farmers.

Table1: Water Requirement for Musa acuminata plants based on the two different cycles [16]

Month	Water Req. it/Day/Plant	Month	Water Req Lit/Day/Plant
June	5-6	October	4-6
July	4-5	November	4-6
August	5-6	December	4-6
September	6-8	January	8-10
October	10-12	February	10-12
November	8-10	March	16-18
December	6-8	April	18-20
January	10-12	May	20-22
Febraury	12-14	June	20-22
March	16-18	July	10-12
April	20-22	August	12-14
May	25-30	September	14-16

RELATED WORK

Internet of Things (IoT) has turned into extremely accepted in the field of communication. IoT will develop into an actuality over the next few years, with fast and prevalent smart devices will be able to perform autonomously according to the modifications in their environs. To build up an autonomous technique to examine the water necessity by the plants at a time, a database is formed. The database holds training samples associated with soil type, moisture content, temperature, plant leaf situation and the humidity point and the quantity of water needed for following features. The database is constructed using the features taken out from the images of the soil and the plants. The plants and the soil images color can be obtained by using

Fisher's linear discriminant analysis. The RGB images are required to be evaluated precisely to decide the water necessity. The graph cut based segmentation can be applied to segment the regions exactly to examine the water content in the leaf and the soil layering the plants can be discriminated. The processing of the images should be performed by differentiating the plant and soil segments. A novel categorization algorithm called transductive support vector machine is used for categorization and quantification [3].

When selfish node and cooperative node is detected, then an incentive is allocated to the nodes which fruitfully delivers the message else no incentive is given to the node [1]. Selfish nodes in the network participate in routing algorithms, however, decline to forward messages may crook a MANET. These problems can be corrected by implementing a reputation system. The reputation system is used to train correct nodes of those that must be avoided in message’s routes. However, the system rewards selfish nodes, which is benefited from not forwarding messages by being able to use the network. The Terminodes [2] project defines a virtual currency named as beans used by nodes to pay for the messages. Those beans may be dispersed by the intermediary nodes that forwarded the message.

On Packet Purse Model, the sender pays to each mediator nodes for the message, while in Packet Trade Model, the receiver is charged. In both models, hosts are charged as a function of the amount of hops traveled by the message. The CONFIDANT [3] algorithm implements a reputation system applicable for the members of MANET. Nodes with a dreadful reputation possibly will observe their needs ignored by the remaining participants, this way not including them from the network. When compared with the previous system, CONFIDANT shows two advantages. It does not require any particular hardware and avoids the “self-inflicted punishment” that may possibly be the operation point for the malicious users. The scheme tolerates certain kinds of attacks are mistrustful on the arriving selfishness and aware that other nodes broadcast and relying mostly on its self-skill. These systems show two approaches that conflict in several aspects. The number of requests received by host is relay upon their geographical location. Hosts may become congested with desires because they are positioned in a tactical point in the MANET. A cooperative node that provisionally supports a lot of requests should be rewarded. CONFIDANT has no memory, so services offered by some host are rapidly elapsed by the reputation system. On the other hand, beans can be reserved for an indefinite period by hosts. In MANETs, it is expected that hosts move regularly, therefore altering the network topology. The number of hops a message has to travel is a function based on the location of the sender and the receiver and differs with time.

ISSUES OF SELFISH NODE

One immediate effect of node false behaviors and failures in wireless Mobile ad hoc networks is the node isolation problem due drop in connections between nodes are completely dependent on routing [8].
Figure 1: demonstrate the infrastructure less network of the node, a typical MANET.

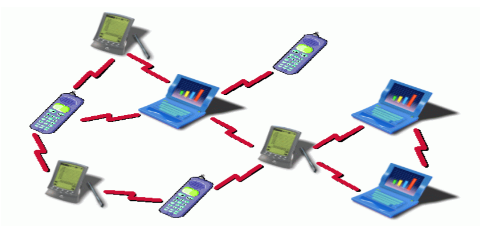

Figure 1: A typical structure of MANET

In turn, the occurrence of the selfish node is a through reason for node isolation and network partitioning, which additionally affects network survivability. Node isolation refers to the observable fact in which nodes have no active neighbors; however, the presence of selfish node can isolate even if active neighbors are available.

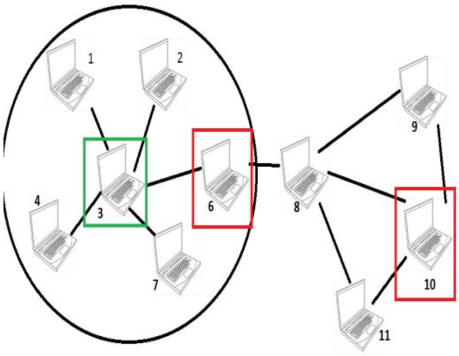

Figure 2: Node isolation problem in MANET

In Figure 2, consider that the node 6 is a selfish node. When node 3 initiates a route discovery to node 10, the selfish node 6 hesitates to broadcast the route request from node 3. The situation could be worse since node 3 may choose node 6 as the next hop and send data to it.

Consequently, node 6 may discard all data to be forwarded via it, and then communications between node 3 and node 10 cannot proceed. When all neighbors of node 3 are selfish, it is unable to launch any communications with nodes at a distance of greater than one-hop away. In this case, it is clear that a node is inaccessible due to its selfish neighbors. Selfish nodes may communicate without nodes, which is diverse from failed nodes.

THE PROPOSED MECHANISM

In the proposed approach, the mobile nodes fitted with soil moisture sensors. The mobile node continuously read the sensor and if moisture level is low, mobile node behaves as a selfish node. Each row in the musa acuminata farm will be implemented with mobile nodes based of the sensor capacity. The mobile nodes periodically broadcast a message regularly. So that the node/nodes which is in the low soil moisture zone will drop the packet and behave selfish The next hop node, will not able to receive the packet and will wait for a time period and uses the selfish node detection algorithms to identify the selfish node and communicate to the other nodes. Then all the cooperative nodes will form a Triangular Cooperative Region (TCORP) and trigger the dripper to irrigate the entire region. In the Figure 3 A typical musa acuminata farm is shown. The musa acuminata plant is cultivated in rows with proper space.

Figure 3: A Typical Musa acuminata Farm

Figure 4 Shows the dripper or emitter. They work as energy dissipaters, reducing the inlet pressure head to zero atmosphere at the outlet. It is used to dipper irrigation which will supply water as required by the plant.

Figure 4: Dripper

The path to any destination will consist of TCOR node only; source and destination node can be a Non-TCOR node.

Table 2: Drip Water requirement at different growth stages of musa acuminata[17]

Sl.	**Crop growth stage**	Duration (weeks)	**Quantity of Water** (litre/plant)
1.	After planting / Ratoon	1-4	Flood irrigation
2.	Juvenile phase	5-9	8-10
3.	Critical growth stage	10-19	12
4.	Flower bud differentiation stage	20-32	16-20
5.	Shooting stage	33-37	20 and above*
6.	Bunch development stage	38-50	20 andabove8

In Figure 5 , Graph Showing Dynamic Irrigation Nature of the Musa acuminata Plants which depicts that the musa acuminata plant will not require an same amount of the water through out the life cycle.

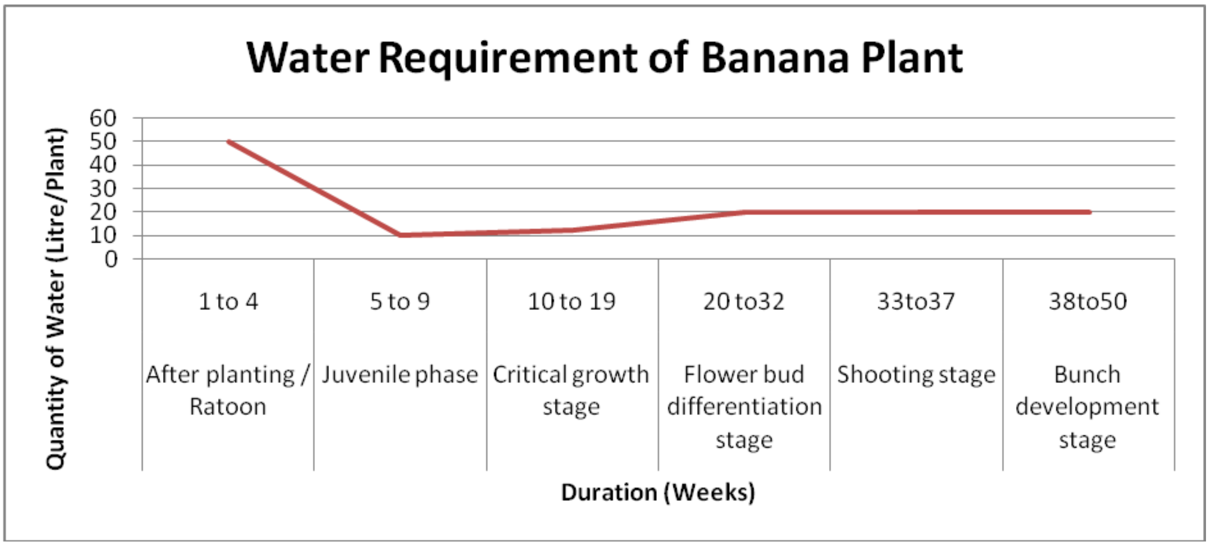

Figure 5 : Graph Showing Dynamic Irrigation Nature of the Musa acuminata Plants

Algorithm1: Formation of Triangular Cooperative Region

Begin

Initiate MANET node in the network // Nodes that are TCOR will form a network path
Detect Non-TCOR nodes using any available high performing algorithm
Make Non-TCOR Nodes as Source / Destination but never as path
Update_Routing_table();
Compute_TCOR_Concentration();
Broacast_Routing_Information();

End

In Figure 6, Consider Node 4 is Non-TCOR node and all the other nodes are TCOR code. Based on nodes category, the routing table will be updated as Table 1 Given below. Based on the algorithm Node 4 will not be a path to any node and it will be only a source node or destination node.

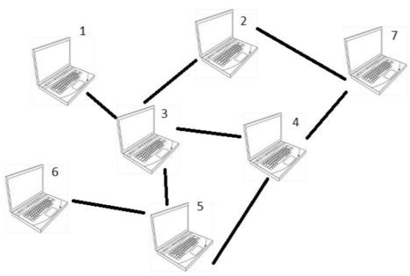

Figure 6: Routing In MANET

Table3: Routing Table for Figure 6 with node 4 as Non-TCOR Node

At Node 1			At Node 2			At Node 3			At Node 4			At Node 5			At Node 6		
Destination	Next Hop	Number of Hop	Destination	Next Hop	Number of Hop	Destination	Next Hop	Number of Hop	Destination	Next Hop	Number of Hop	Destination	Next Hop	Number of Hop	Destination	Next Hop	Number of Hop
2	3	1	1	3	1	1	1	1	1	3	1	1	1	1	1	1	1
3	3	1	3	3	1	2	2	1	2	3	1	2	2	1	2	2	1
4	3	1	4	3	1	4	4	1	3	3	1	4	4	1	4	5	2
5	3	1	5	3	1	5	5	1	5	5	1	5	5	1	5	5	1
6	3	1	6	3	1	6	6	1	6	5	2	6	6	1	6	6	1
7	3	2	7	7	2	7	2	2	7	7	1	7	3	3	7	5	3

CONCLUSION

Musa acuminata is a heavy feeder crop/. Therefore, fertility of soil is very important. Rich, well drained, fertile, free working, soils with plenty of organic matter are best suited for cultivation. The optimum range of pH of soil should be 6 to 8. The proposed method will effectively address the issue of the irrigation of the musa acuminata farms dynamically based on the water moisture level on the soil. The selfish node problem which is an issue in the MANET is used as the application in the proposed method to recognize the region where the where the plants has to be watered. The dipper will be triggered as per the requirement and so even when there is a less available water the plant can be water efficiently by this method.

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