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# Onion Loss Detection, Automatic Roof Opening and Closing against Rain & Optimum Ventilation Providing System

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**ABSTRACT:** The percentage of production of onion in overall production of vegetable in India seems increasing day by day. Onion has become an important commercial crop of India. It is also observed that Indian climate is becoming more erratic day by day which may cause onion loss in all possible ways and keep increasing rapidly. To obtain desired benefits from onion to farmers, it should be stored under a shade or godown with controlled environmental parameters like temperature, humidity, air pressure etc. which is not possible for every Indian farmer. So authors are proposing an electronic system which will help farmer to control his onion losses. When rotting starts, using sensors, system will alert owner (farmer) in different ways and provides optimum ventilation to stored onions. If rain occurs, opened roof will be closed automatically.

**KEYWORDS:** Onion loss, Environmental parameters, Electronic system, optimum ventilation etc...

### I. INTRODUCTION

As a maximum grower of onion, India holds second position in the world. According to ICAR - Directorate of Onion and Garlic Research, the cultivation in India is growing day-by-day [1]. Also, it has a major impact on national economy and financial status of growers and the consumers. Therefore it has become an important commercial crop of India. It is estimated that out of the total production of 41 lakh tonnes of onion, 40 to 50 % valued at more than Rs 600 crores are lost due to desiccation, decay and sprouting in storage(Kukanoor, 2005). This results in raise in their price to the tune of four to five times[2]. Indian bulbs are having higher water content. The temperature between 10-25°C increases sprouting. More the relative humidity, more is rooting. Weight loss is more when temperature is above 35°C. it is also observed that, due to unexpected raining there are a large amount of onions gets unusable. Other than throwing them out, farmers don't have any other options. This action of theirs may cause environmental issues. To control all these problems on some extend, we propose Onion loss detection, automatic roof opening and closing against rain & optimum ventilation providing system.

Here, detection of onion loss can be done using different sensors, microcontrollers and transducers [1] which works on the principle of sensing different gases emitted by onions and comparing them with their desired threshold values. Opening and closing of roof depends upon requirement of ventilation to be provided and presence of rain. If rain is present, roof of onion shade will remain closed. If we need to provide ventilation to stored onions and rain is not present, roof will be opened. In this way maximum ventilation can be provided to the stored onions and onion losses can be controlled.

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## II. RELATED WORK

Onions, one of the biggest vegetable crops in Georgia, risk disease when they are harvested and stored. To solve this issue, University of Georgia researchers have developed new technologies, including a gas sensor and imaging methods, to detect diseases in onions[11]. A gas sensor array, consisting of seven Metal Oxide Semiconductor (MOS) sensors that are sensitive to a wide range of organic volatile compounds was developed to detect rotten onions during storage [12]. But such techniques of detection are not affordable for Indian farmers. J Food Sci Technol. in Jun 2012 given a view on onions that The Indian onion bulbs have higher water content[4] making them more susceptible to rotting. In India, there is no such electronic system available yet, that will help us in a way to reduce/prohibit these losses. Prof.V. G. Waghand Mr. S. A. Pawar **proposes an** integrated system which introduces a different and convenient option for preventing or reducing onion losses [1]. Such system was not capable of providing a barrier against unexpected raining. We provide a system which can provide a the same safety against unexpected raining and also give maximum ventilation to a storage.

## III. SYSTEM UNDERSTANDING

To understand the construction of system, consider the following block diagram. It consists of different sensors at its input to detect respective (desired) parameters and a rain sensor to sense the presence of rain. Detected parameters will be compared against their threshold values and suitable actions are taken against it for controlling onion loss. Ventilation system should be kept inside the onions so that ventilation should move through stores onions. Following fig 1. shows block diagram of the system with sensors at the input, microcontroller as the controller and transducers at the output. One can select their desired output devices. Using LCD display and Audio alarm is optional depending on owner's desire.

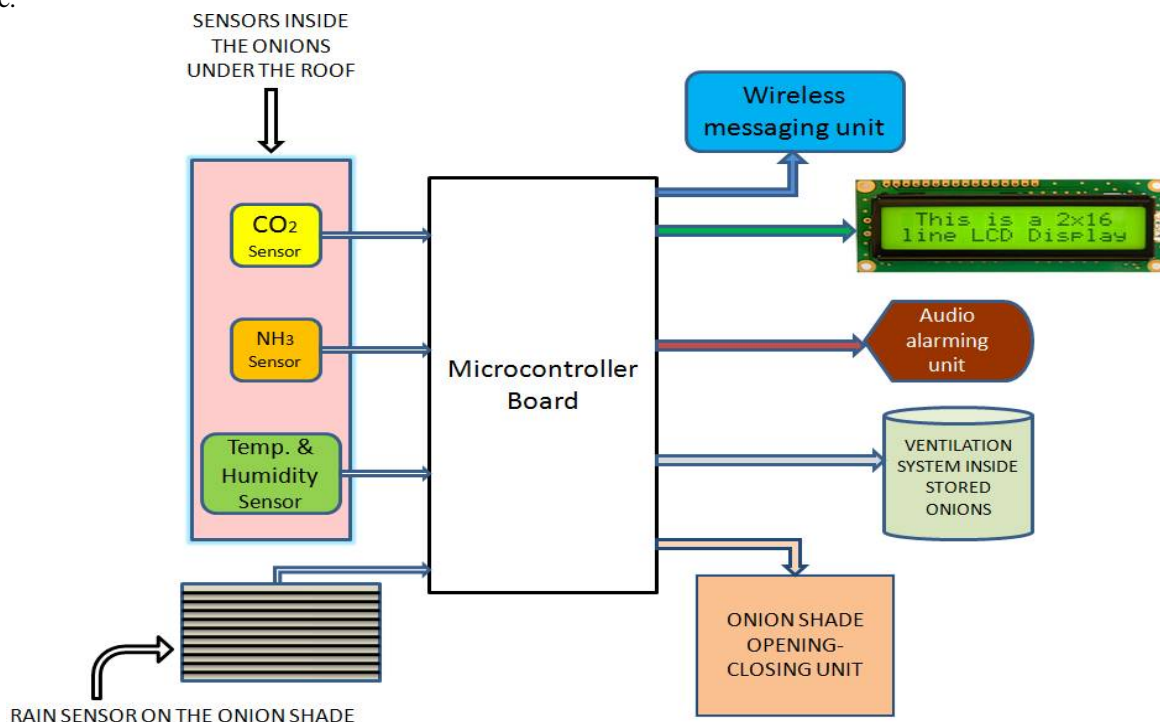


Fig 1: BLOCK DIAGRAM OF THE SYSTEM

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Above Fig 1 shows block diagram of the system. Microcontroller (on an arduino board) is there which accepts the outputs of sensor and then functions accordingly to detect onion loss and therefore provide optimum ventilation to control these losses using actuators like parameter controlling agents such as heater/cooler (or both), display, an alarm and roof opening-closing system.

## IV. WORKING OF THE SYSTEM

### 4.1 Working Principle-

This system works on the principle of sensing different parameters like different gases emitted by onions and the rain, comparing their values with their desired (threshold values) and performing a required action with the help of sensors, actuators and transducers against any unwanted behavior/functioning/result/observation in the system or in a surrounding environment of the system.

To understand the working of the system, consider following flowchart-

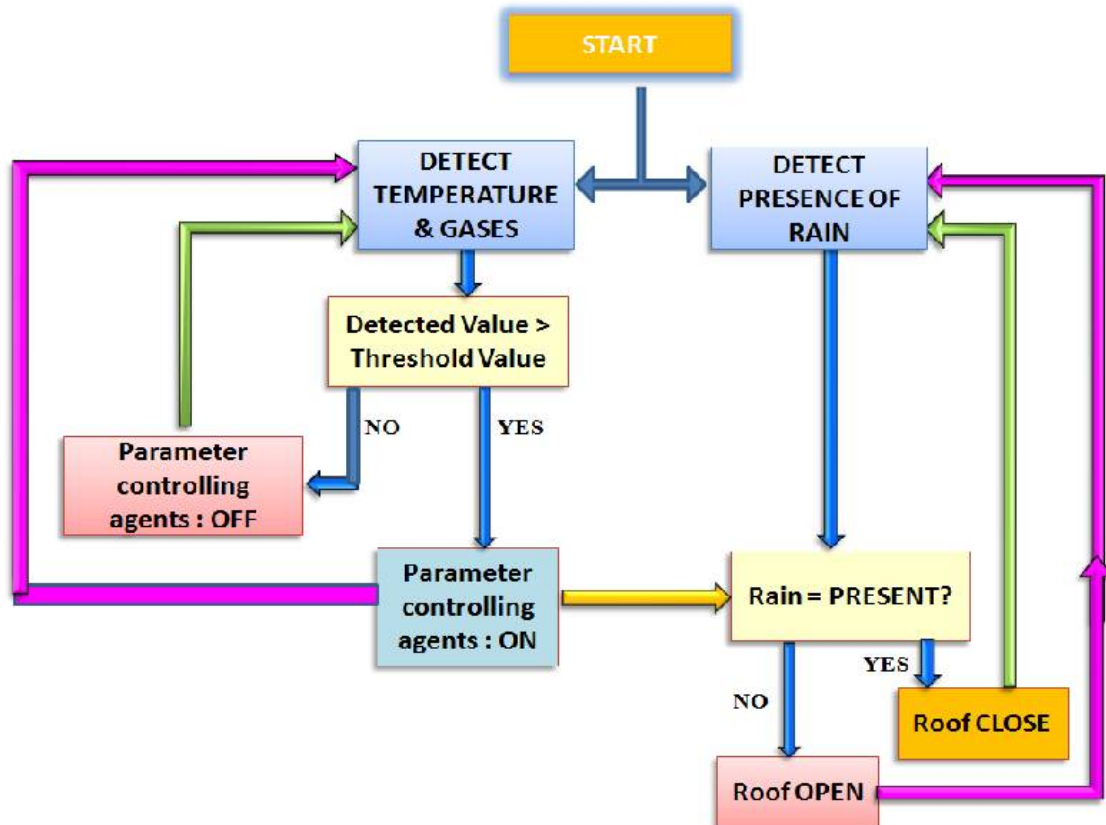


Fig 2: FLOWCHART FOR UNDERSTANDING THE WORKING OF THE SYSTEM.

Above Fig 2 represents the working of the system. In this system, when ventilation is required controlling agents switch ON and also if rain is absent shade roof is also opens so that proper ventilation can be provided. If rain is present roof remains closed.



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### 4.2 ADVANTAGES:

System is low cost, affordable and easy to implement with low maintenance.

Automatic onion shade roof opening and closing against rain.

Using multiple sensors, rotting can be found at earlier state.

The same principle can be used for maintaining freshness of vegetables considering their parameters and their optimal control range requirement.

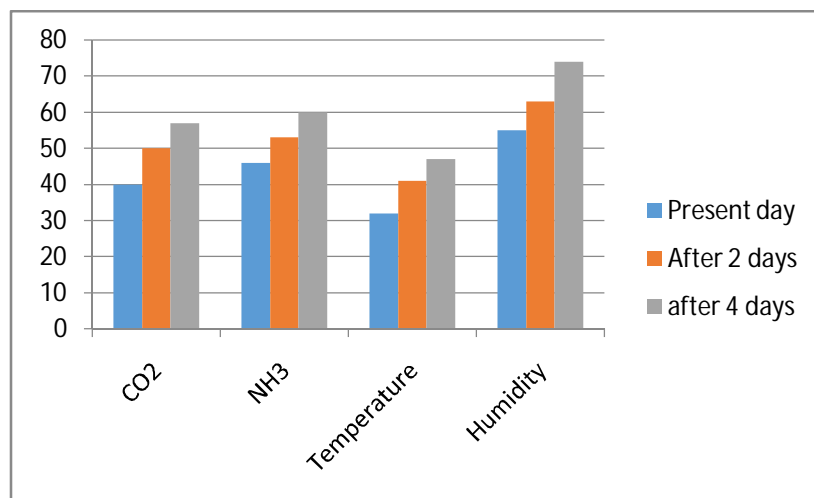
### 4.3 TESTING THE SYSTEM:

Parameters measured for fresh onions and then after initializing rotting process by spreading water on it(after 2 and 4 days from the same samples)...

Parameter	Present day	After two days of rotting started	After four days of rotting started
Carbon Di-oxide	35 to 45	45-52%	55 - 60%
Ammonia	45 to 48	50-55 %	59 - 68 %
Temperature	32 <sup>0</sup> C	37 <sup>0</sup> C	42 <sup>0</sup> C
Humidity	Up to 55 %	62 to 65 %	Above 70 %

**Table 1: TENTATIVE OBSERVATIONS FOR DIFFERENT PARAMETERS TAKEN IN A LABORATORY.**

Table 1 represents observations taken for different parameters like Carbon di=oxide, ammonia, temperature and humidity etc. we took measurements of fresh onions for present day i.e. the day when we started experimental measurements.



**Fig3: COMPARATIVE VISUALIZATION OF DIFFERENT PARAMETERS WHILE TESTING THE SYSTEM**

We spread some water on fresh onions, kept it for two days in open environment in wooden box with metal sheet as a roof and performed the same readings. After two more days i.e. four days after rotting started, we again took the



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same measurements and it is observed that the percentage of rotting has increased on a large amount. This indicated that when rotting started, the level of these parameters rises rapidly and after an interval of time controlling the rotting process becomes difficult. This indicates that if we detect rotting, at its initial stage i.e. when levels of parameters are greater than their desired threshold values, it can be detected and rotting can be controlled [1].

## V. RESULT

For fresh onions (sample), the output readings seems to be controlled (within the range) according to Indian environment. We started rotting process and performed the same procedure and we observed that the values of parameters are getting increased rapidly. In India considering erratic environment monitoring temperature and various parameters are important. In addition to that rain is also a considerable parameter.

We can provide proper ventilation to stored onions in onion shade by using appropriate ventilation system, and controlled air presser and light intensity by using shade net. Also we made an automatic roof opening and closing system in which onion shade- roof remains open when no rain is there, and closed when it is raining.

## VI. CONCLUSION

By using this system, one can monitor all the desired parameters and provide maximum controlled ventilation to stored onions with shade-roof opening closing system. This system will provide three way notification to owner (farmer) by mean of audio (alarm), display and wireless message (sms). It is low cost, low maintenance and easy to install, anyone can afford it. We can have real time data which can be used for future research/purposes.

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