Power Research on Intelligent Controller of Exposed Tea Fixation Machine Based on STM32

Qinghua Han1,2, Mingdeng Shi1,2,* and Xiao Li1
1College of Information Engineering, Tarim University, Alar 843300, China
2Key Laboratory of Modern Agricultural Engineering, Tarim University, Alar, China

*Corresponding author email: 120070033@taru.edu.cn

Abstract. During the processing of the traditional fixation machine, the temperature is difficult to control, which affects the quality of tea frying. In order to solve this problem, Taking STM32 MCU as the control chip to complete the intelligent control of each functional module. All units are uniformly controlled by a microprocessor, and at the same time, intelligent communication equipment can be used to realize remote monitoring, view real-time production status, and control progress. In addition, the original tea farmer’s machinery can be modified on-site to promote production, and the cost of the installation is lower, which is of great significance to the revival of the tea-horse culture on the “New Silk Road”.

Keywords: STM32; Tea fixation machine; Remote control.

1. Introduction
At present, the degree of mechanization of tea is very high, and mechanized production is generally realized, but the degree of intelligence is seriously insufficient, In particular, tea production has the peculiarities of picking during the day, processing at night, and not being able to stay overnight, causing many tea farmers to stay by the machine at all times[1], the traditional exposed tea fixation machine controlling the preheating, starting, producing, releasing, and stopping of the machine, which causes the switch to be easily damaged[2]. At the same time, people need to observe the whole process to ensure that the tea fixation. If the temperature is very high during tea processing, it is easy to excessive fixation. Some tea farmers even need to manually sprinkle water to quickly reduce the temperature of the tea. Tea farmers are prone to fatigue after working for a long time. In addition, visual errors cause the color of the finished tea to be different, which affects the tea[3].

2. Materials and Methods

2.1. Introduction to the Study Area
The production of Lu'an melon slices is the experimental object. Lu'an melon slices are produced in the Yu'an District of Lu'an. The mountainous hills of Jinzhai and Huoshan counties are divided into two major producing areas, inner mountain and outer mountain. Melon slices are divided into raw pot and cooked pot. The two pots are used together. The raw pot is fried first and then the cooked pot is fried. The temperature of the raw pot is slightly higher, reaching above 100°C, which destroys the enzymes in the tea leaves, so that more and more chlorophyll are retained.

2.2. Test Method
In view of the current problems and shortcomings of tea finishing in China, in order to improve the
working conditions and technology of tea fixation, and to improve the quality of tea processing, the comparison test between new tea fixation methods and traditional fixation methods is carried out, finding a better way for tea fixation. Fresh leaves of the same tea plant species with the same tenderness standard were used as the test materials, and the same spreading degree and method were used. Then the spreading leaves were processed at the same time according to different curing processes for the quality determination of the tea after the tea fixation. Compare them by looking at the leaves and smelling the aroma. The results of its quality performance is the appearance of the leaves of the new type is green and uniform, and the fragrance is high; the appearance of the leaves of the traditional type is dark green, which is easy to produce focal points.

2.3. The Biochemical Composition of Tea

The quality of tea is the comprehensive effect of many compounds in tea, especially the substances that can be dissolved in tea soup, on human sensory stimulation. Factors include color, aroma, taste, shape, etc. The formation of these factors is based on the content and proportion of chemical components in tea. The taste and aroma of tea are formed by the comprehensive influence of multiple components. The unique tea polyphenols, amino acids, caffeine, catechins and total soluble sugars in tea have a decisive effect on the quality of tea. Amino acids are closely related to the taste, aroma and nutritional value of tea; caffeine has a positive effect on the formation of tea taste, freshness and refreshing; tea polyphenols affect the taste and color of tea soup; the higher the total soluble sugar content, the relative taste The sweetness is obvious; Catechin is a functional active ingredient of tea, which has a wide range of health and pharmacological effects and strong food antioxidant properties. Green tea is characterized by clear soup and green leaves. Chlorophyll is the material basis for the color of green tea. The higher the chlorophyll content, the greener the tea color.

The biochemical components contained in the tea leaves after being treated with the new and traditional curing methods were tested and compared. The results of the test comparisons are shown in Table 1.

| Fixation methods | Component testing content | tea polyphenols % | caffeine % | total soluble sugars % | amino acids % | chlorophyll mg/g | catechins % |
|------------------|---------------------------|------------------|-----------|------------------------|---------------|-----------------|------------|
| New fixation     |                           | 22.16            | 2.68      | 15.42                  | 3.36          | 2.46            | 10.42      |
| Traditional fixation |                     | 21.31            | 2.48      | 14.55                  | 3.16          | 2.01            | 10.13      |

It can be seen from Table 1 that the contents of tea polyphenols, etc. in the new tea fixation are significantly higher than those of the traditional. The test shows that the new tea fixation machine can Effectively improve the quality of tea.

3. Overall Design and Working Principle

3.1. Overall Design

Using the existing temperature and humidity sensor and high-speed capture technology, real-time transmission of tea production progress, analog signals into digital signals, achieving remote control, this paper designs a new type of tea processing machine controller, promoting the tea industry from mechanization Move towards intelligence, further promoting the traditional tea culture, and promote the development of China's material cultural heritage.

The new tea fixation machine is mainly composed of a microcomputer control circuit, a mechanical body, and a remote control system. The mechanical body also contains a temperature and humidity sensor unit, a high-speed photographing unit and a humidification unit. The mechanical body also contains a manual switch to Prevent the occurrence of special circumstances. Its structure is shown in
3.2. Control System Circuit Design and Working Principle

Using the bottom control part to effectively select the battery can also solve the problem of battery failure. As shown in Figure 2, the leftmost is the temperature and humidity detection unit and the high-speed capture unit. At the same time, the voltage acquisition circuit and switching circuit in the control circuit are used. Basic voltage acquisition circuit and data detected by the control part.
The tea finishing and stripping machine is designed to shoot tea leaves, a humidification mechanism for spraying water mist, and to receive and process the information transmitted by the shooting mechanism, and transmit instructions to the humidification mechanism to control the operation of the humidification mechanism. It realizes the monitoring of the frying state of the tea in the wok, and can add moisture to the tea in a timely manner to improve the quality of tea frying; and due to the design of the shooting mechanism, the user does not need to stare at the wok all the time.

4. Analysis of Tea Fixation Results
The tea fixation machine can destroy and passivate the oxidase activity in the fresh tea by high temperature, inhibit the enzymatic oxidation of tea polyphenols in the fresh leaves, and evaporate part of the water in the fresh leaves to make the tea soft and easy to twist and shape. At the same time, it emits a green fragrance and promotes the formation of a good fragrance. The new type of tea fixation machine designed in this paper has applied for a new practical patent, with low cost, stable performance and simple structure.

4.1. New Tea Fixation
In the experiment, the fresh tea leaves of the same quality and the same quality were processed for curing, and according to the test requirements, the equipment preheating time, the number of leaves, the curing time, the amount of coal burned, and the power consumption were recorded in time, and the moisture content and freshness of the tea sticks after the curing were measured. The appearance, color, odor, etc. of the leaves were recorded in parallel experiments, and the data were averaged, as shown in Tables 2 and 3.

| Serial number | Fresh weight(kg) | Fixation weight(kg) | Preheat time(h) | Processing time(h) | power consumption(kwh) | Fuel weight(kg) |
|---------------|------------------|---------------------|-----------------|-------------------|------------------------|----------------|
| 1             | 50               | 29.0                | 0.28            | 0.27              | 20.2                   | 0              |
| 2             | 50               | 27.6                | 0.20            | 0.25              | 18.5                   | 0              |
| 3             | 50               | 28.0                | 0.23            | 0.29              | 20.8                   | 0              |
| average       | 50               | 28.2                | 0.24            | 0.27              | 19.8                   | 0              |

| Serial number | Fresh weight(kg) | Fixation weight(kg) | Preheat time(h) | Processing time(h) | power consumption(kwh) | Fuel weight(kg) |
|---------------|------------------|---------------------|-----------------|-------------------|------------------------|----------------|
| 1             | 50               | 28.6                | 0.52            | 0.26              | 3.90                   | 23.5           |
| 2             | 50               | 28.7                | 0.50            | 0.29              | 3.95                   | 24.0           |
| 3             | 50               | 31.2                | 0.60            | 0.29              | 4.45                   | 26.8           |
| average       | 50               | 29.5                | 0.54            | 0.28              | 4.10                   | 24.8           |

4.2. Comparison of Test Results
The new tea fixation and traditional of the test results are compared according to the following calculation formula:
Productivity = fresh weight /processing time, unit (Kg/h)
Water evaporation rate = (weight of fresh leaves -weight of tea leaves after processing) / weight of fresh * 100%
fixation cost = total production cost / quantity of fresh leaves = (electricity fee + fuel cost) / quantity of fresh leaves, (where electricity price is 1 ¥/Kwh, coal is 1400¥ /T, and labor is calculated at 12 ¥/h).
According to the data in Table 2 and Table 3, the comparative data of the test results is calculated, as shown in Table 4.
Table 4. Comparison of fixation test results data.

| Fixation methods               | productivity(Kg/h) | Water evaporation rate(%) | Fixation cost(¥/kg) | Shape quality     |
|-------------------------------|-------------------|---------------------------|---------------------|------------------|
| New fixation                  | 185.2             | 43.6                      | 0.5256              | Green fragrance  |
| Traditional fixation          | 178.6             | 41.1                      | 0.9788              | Dark green focal |

It can be seen from the data obtained from the test that the cost of the new tea fixation machine is only 54% of the traditional. In addition, the new tea fixation machine temperature control has high accuracy and small deviation, so that the cylinder temperature can be kept stable, and the water evaporation rate in the parallel test is relatively stable. Conducive to the subsequent processing of tea.

5. Conclusion
The new tea fixation machine has a high degree of intelligence, realizing the mechanization of tea production to intelligentization. The temperature and humidity sensor realizes data collection throughout the production process, ensuring that the control circuit converts analog signals into digital signals in real time, thereby realizing remote control, reducing labor and facilitating operation. The single-chip microcomputer is cheap and suitable for large-scale promotion. Moreover, my country's tea plantation has a wide range of varieties, and the market prospect of the new tea fixation machine is broad.

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