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Design of an Arduino Uno-Based Garden Security System for Corn from Pests Using RTC as a Timer

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KEYWORDS
Arduino-Uno, Pest, Inverter, RTC

ABSTRACT
This study aims as a security system for corn plants from Arduino-based pests using a DC to AC inverter with a 220V output as the output, and designing the Arduino Uno microcontroller system to work automatically by using the RTC as a timer, aims to make it easier for corn farmers to operate this equipment. Swine pests are a serious threat to farmers because they can cause crop failure, many farmers are already bothered by the presence of pig pests. The results of this study are a 12 Volt 6 AH battery as a voltage source to provide voltage to the Arduino Uno microcontroller, RTC relay, and inverter circuit as output. The RTC sensor is used as a timer, which disconnects and connects the battery current to the inverter using a 5v dc relay. This tool works at night for 12 hours, from 18.00 to 06.00 in the morning, and from 06.01 to 18.01 the RTC module will actively give a signal to the relay to connect and disconnect the battery voltage current to the inverter. With this tool, it makes it easier for farmers to monitor the safety of the garden corn plants from pests, and no longer need to go to the garden at night for manual installation..

Introduction

The development and advancement of technology are currently developing so rapidly in tandem with science and the development of human civilization. Technological developments are felt to have touched all aspects, there is no space that technology does not enter, one of which is electronic technology[1]. The computer has now become the main tool for humans and is used not only to solve problems at work, create programs or play games but can be used as a tool to program microcontrollers so that they can run according to their functions and with the technology that continues to develop today[2].

Indonesia is a country where most of its people earn by farming. As a country that has a wide variety of flora and fauna, especially in plantation areas, it is important to pay attention to the presence of pig pests[3]. In Indonesia, there are species of wild boar, including susvitatus and susbarbatus. These pigs can give birth twice a year with up to 10 children. These wild animals eat anything (omnivorous), for example, tubers, banana trees, sugarcane,

and young oil palm. (Ir. Suyatno Risza, Efforts to increase oil palm productivity) Pigs are a threat to farmers[4].

This beast often damages seeds, fruit, tree roots, and shoots of young plants, intercropping planting systems, especially those using tubers, will often be visited by wild boars[5]. Swine pests are a serious threat to farmers because they can cause crop failure, and many farmers have been disturbed by the presence of pig pests. Some have overcome it by using the manual method, namely by being poisoned and hunted[6].

One of the pig pests is the wild boar, generally these wild boars often damage and attack newly planted trees or young trees as a result of which the trees are damaged and even die. Pig pests are a threat to farmers[7]. These animals often damage seeds, fruit, tree roots and young shoots, intercropping planting systems, especially those using tubers, will often be visited by wild boars[8]. Swine pests are a serious threat to farmers because they can cause crop failure, many farmers are already bothered by the presence of pig pests[9].

Technological developments in Indonesia are currently widely used in various activities and jobs such as in managing agriculture[10]. The the existence of technology that exists at this time can help human work in various fields to be better and more efficient. One form of technology that can help human work is Arduino development technology which utilizes PIR sensors to be able to monitor plantations for animal disturbances[11].

In managing crops, many farmers complain because many plants are attacked by animals that destroy plants from planting to harvesting, so the results obtained will be reduced. Animals that usually disturb farmers' plantations such as monkeys and pigs[12]. To reduce this problem several techniques for plant-destructive animal control have been carried out. However, the efforts made were not effective. Farmers cannot detect when these destructive animals will come to destroy their plantations[13]. Farmers need a lot of energy and time to go around the garden area to find the existence of these disturbing animals. To overcome the problems above, the researcher designed a tool to detect garden pests that can be connected via a cellphone with an SMS Gateway which can make it easier for farmers to deal with attacks by these plant-destroying animals[14].

Arduino is an open-source based microcontroller system. The term Arduino can be divided into two systems, namely hardware and software[13]. An open-source system both in hardware and software can provide quite a lot of inspiration in the design of electronic systems. The microcontroller of the ATMEL family is the core of the Arduino processor. Like ATmeg8 ATmega2560 and others[15].

To minimize losses in farming, garden security is a very important thing to pay attention to[16]. To use technology that is currently developing and has touched all aspects of people's lives, including in agriculture, a tool is needed to support the productivity of farmers through a device that controls remotely (automatically)[17]. On this basis, the author is interested in submitting research with the title "Design Of A Garden Security System In Corn Plants From Arduino Nano-Based Pests Using RTC As A Timer"

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Research Methods

The design of this system is carried out in several stages:

a. Hardware Design

Arranged from several components of the tool starting from the battery which is used as a power supply source of electrical energy that works at night, Step down the module to lower the 12V voltage to 6V as an Arduino source that controls the equipment as a whole equipment.While the RTC is a barrier to the activity of this tool by disconnecting the network to the relay, while the relay disconnects and connects the flow of electricity in the circuit. The inverter itself is used to convert DC voltage to AC voltage. Furthermore, the voltmeter is

used to measure the amount of electric voltage that exists in an electric circuit in a certain quantity and unit

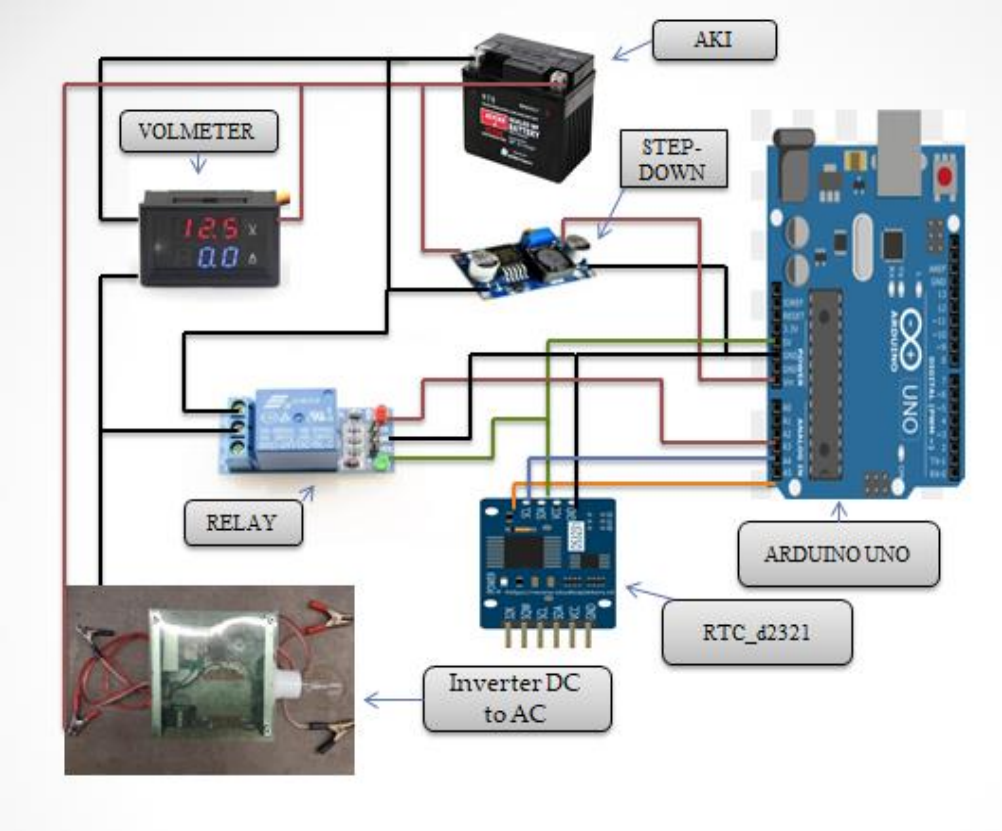

Figure 1. Hardware Design

b. Schematic Arduino nano

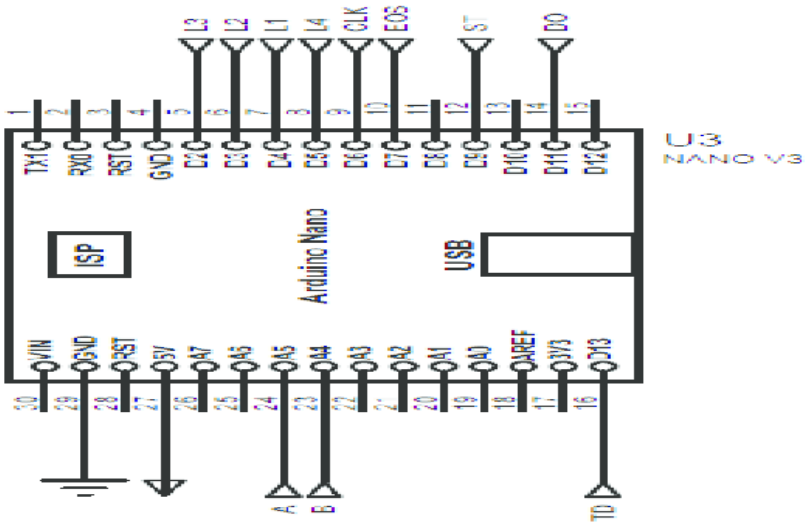

Figure 2. Schematic Arduino-Uno

c. Schematic RTC

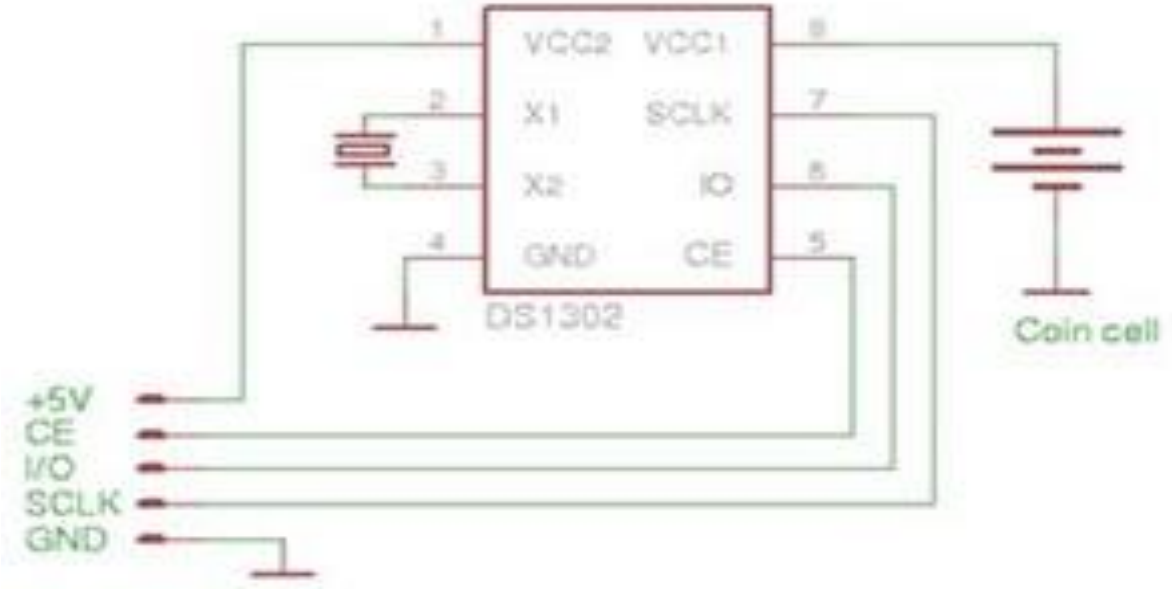

Figure 3. Schematic RTC

d. Schematic Relay

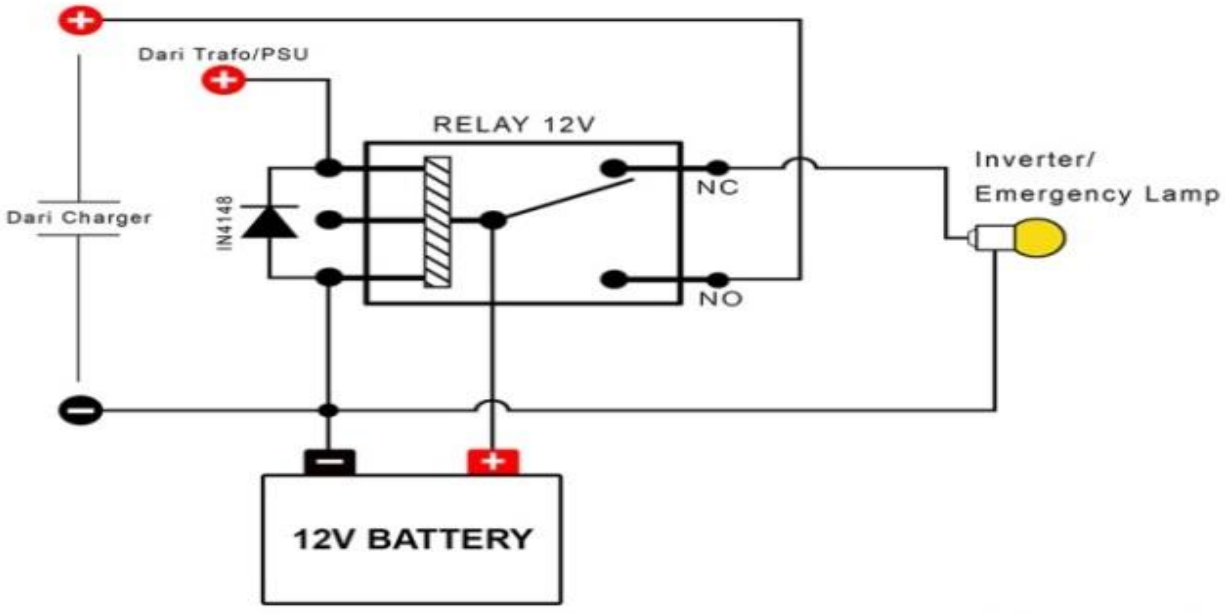

Figure 4. Schematic Relay

e. Schematic Hardware Design

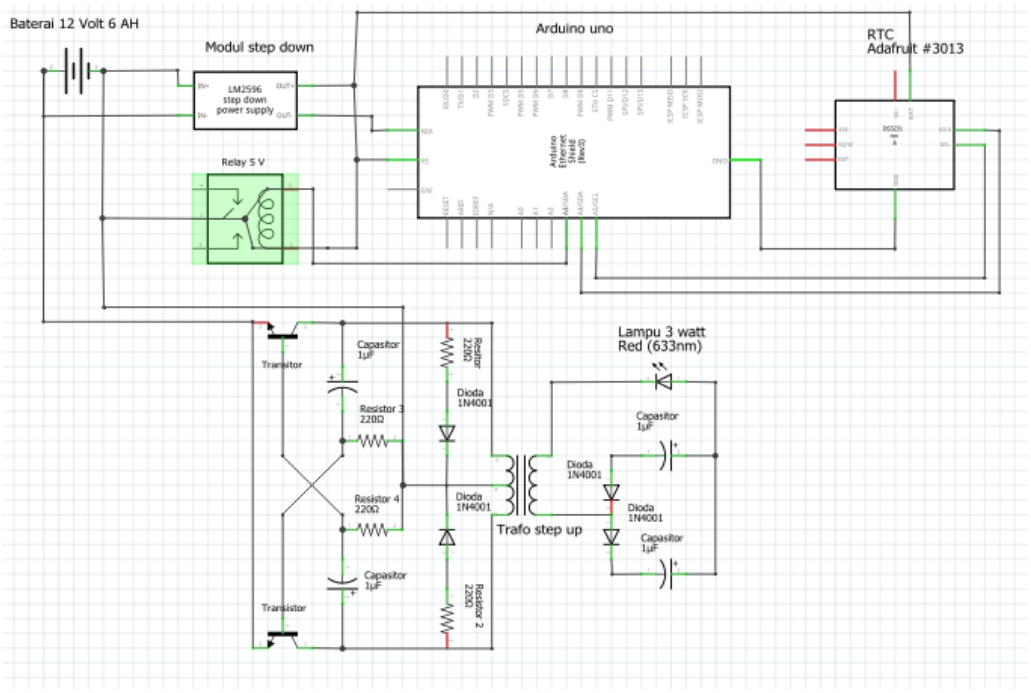

Figure 5. Schematic Hardware Design

f. Flowchart of Research and Design Project

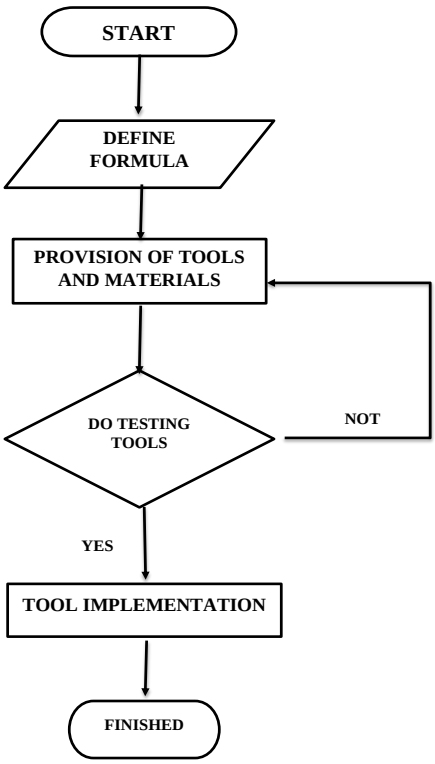

Figure 6. Flowchart of Research and Design Project

Results and Discussions

A. Testing Purpose

This test is one of the important steps that must be carried out to find out whether the system created is what is planned, this can be achieved during system testing. In addition to knowing whether the system is working effectively as expected. Testing also aims to determine the advantages and disadvantages of the system created.

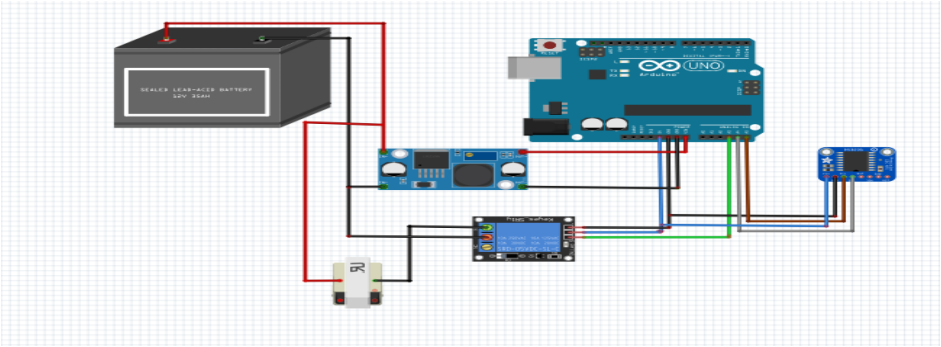

Figure 7. Research Result

The following is an explanation of the circuit scheme in Figure 7. The power supply as the main input uses a 12V voltage from the battery and then lowers it to 5V by stepping down AC to DC to activate the microcontroller. The second input is the RTC (Real Time Clock) which provides information in the form of time. The output or output of this tool is a relay that opens the flow of electricity which will become a trap for animals destroying corn crops by passing an electric current to the wire surrounding the plantation area, the relay. such as a switch from a 12V battery to an output controlled by Arduino Uno using an RTC as a time sensor. Apart from that, the 12V voltage supply is also used to power the incandescent lamps in the dc to ac inverter and continue to the 110V wire.

Tool Work Process Flowchart

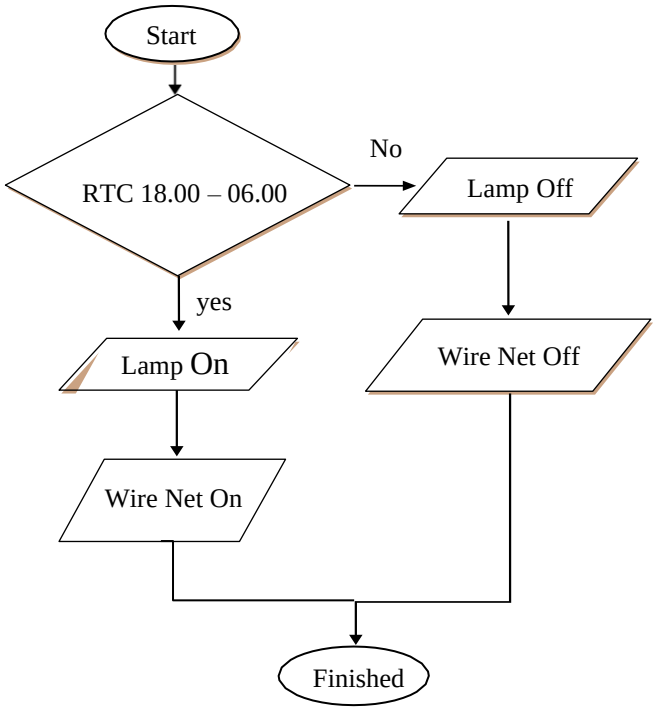

Figure 8. Tool Work Process Flowchart

The working principle of this tool is when the time shows 18.00 - 06.00, the lights will be active which are used as pest attractants, and wire nets which will also be active together with the lights and installed around the lights which will sting insects that approach.

B. Discussion

1) Arduino Uno

This Arduino Uno is a component that is the control center processing signals from the RTC relay and making decisions. To the tests that have been carried out, the Arduino Uno can work properly. This is proven by all the components in this tool that are connected to Arduino and able to work optimally. The use of ports in the Arduino UNO microcontroller is as follows:

1. Port GND/GND
   The GND/GND port is used as an input that will be connected to the GND RTC pin
2. Port 5V/VCC
   This 5V/VCC port is used as an input that will be connected to the VCC RTC pin.
3. Port A4/SDA
   This A4/SDA port is used as an input that will be connected to the SDA RTC input pin.
4. Port A5/SCL
   This A5/SCL port is used as an input that will be connected to the SCL RTC input pin
5. Port GND/GND.
   The GND/GND port is used as an input that will be connected to the GND relay pin.
6. Port 5V/VCC
   This 5V/VCC port is used as an input that will be connected to the VCC pin on the relay.
7. Port 5V/VCC
   This 5V/VCC port is used as an input that will be connected to the VCC pin on the Relay.
8. port A3/IN
   This A3/IN port is used as an input that will be connected to the VCC pin on the relay.

2) Microcontroller Voltage Test Results

The following data from the microcontroller voltage test results are those shown in

Table 1**.** Results Of Microcontroller Voltage Tests

No	Indicator	Measurement To	Vin (Volt)	Vin Scalable (Volt)	Difference Measurement
1	No burden	1	10	10,56	0,56
		2	10	10,5	0,5
		3	10	10.59	0,59
2	With loads	1	10	6,40	3,6
		2	10	6,34	3,66
		3	10	6,32	3,48

From the results of the microcontroller voltage test, it is found that if no load is given, the average output voltage is 10.55 Volts with a measurement difference of 0.55. the average result of 3.64 above, does not have much effect on Arduino Uno because the voltage range for Arduino Uno NO is 7-12 Volts.

3) Relay testing and tension wire

This test is carried out to ensure whether the relay is functioning properly when the RTC sends a signal.

Table 2. Testing Of The Relay And Voltage Wire

No	Condition RTC	Condition Relays	Measurement of Tension Wire Network		
			Voltage (V)	Current (A)	Power (W)
1.	ON	HIGH	1224	0,4	489
2.	OFF	LOW	0	0	0

The table above is the result of testing relays and measuring voltage wire nets. When the RTC is on, the relay will also be high, and vice versa.

4) Overall System Performance Test

Table 9. Relay Conditions

No	RTC conditions	Condition of Relays
1	OF	HING
2	ON	LOW

When the time specified by the RTC has arrived or the RTC is ON, it will decide or make a relay that was NC (normally closed) to NO (normally open) which makes the device or signal to be sent to Arduino. The overall performance of this tool is a combination of hardware and software that has been integrated into a system. By the overall test results, this tool can function properly. The components used in this tool are rtc and relay. If the RTC gets an order from Arduino, then the RTC gives a signal to the relay, where the relay functions to disconnect or continue the current from the battery to the inverter, then on to the live aluminum wire. When the inverter gets voltage from the battery, the incandescent lamp will turn on and pass the voltage to the aluminum wire. Where when the pests of pigs touch the wire, the incandescent lamp lights up.

Conclusion

In this research, the writer can conclude that the tool. "Design of a garden security system on corn plants from Arduino Uno-based pests using RTC as a timer" shows the results by the plan. The input voltage is 12V AKI and the Arduino Uno microcontroller type, sensor used is the RTC sensor as an accurate timer. Invert as output. This tool works for 12 hours per day, from 18.00 to 05.00, and from 05.01 to 18.01 the RTC module will be active to break the circuit to the inverter. This tool works automatically so that it makes it easier for corn farmers and no longer goes to the garden for manual installation.

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