

CHAPTER-4

SYSTEM IMPLEMENTATION

4.1 INTRODUCTION

In order to overcome the disadvantage of the existing system, solution is framed in the domain of IoT in Mechatronics. IoT is emerging as a boon to humankind by offering a vast variety of reliable services. The proposed Design of twin blade Digital vegetable cutter is also an IoT based mechatronics solution to eliminate the difficulty in chopping the vegetables. The system is implemented by modularizing it into 3 parts depending on its working. The factors considered for making these three modules were the entities involved in chopping the vegetables. The entities are vegetable cutter, Mobile Phone and the android application to operate it. Module 1 is a “Bluetooth devices Pairing” where the android application in the mobile phone is paired with vegetable cutting machine’s Bluetooth module (HC-05). Module 2 is a “Choosing the type of blade” where the user will choose the type of blade using the android application in the mobile phone i.e. click the button which type of blade is needed to chop the vegetables. Module 3 is “Cutting the vegetable” which involves the activation of pneumatic cylinder to cut the vegetables into the user’s desired shapes by applying required pressure on the vegetable.

4.2 BLUETOOTH MODULE

Module 1 is also called “Bluetooth devices pairing” is a communication link between mobile phone(including mobile android application) and the vegetable cutter. With the help of Bluetooth module, which is one of the wireless communication technologies, the mobile phone and the vegetable cutter are connected. Communication between these two entities is provided with the help of Bluetooth module. In addition to this, Stepper motor and its Driver A4988 is attached with the vegetable cutter. The Figure 4.1 represents the connection of the Bluetooth module with Arduino UNO board. Mobile

phone and the vegetable cutter get paired with the help of Attention commands (AT). This happens when both the mobile phone and the vegetable cutter is within the range. This also conveys that when the mobile phone moves from the vicinity of the cutter, the connection between them will be lost. The Table 4.1 represents the pin configuration of the Bluetooth module with the Arduino. The work of Stepper motor starts when the user chooses the type of blade(Button 1 and Button 2) in the mobile application, in order to cut the vegetables into the shapes from which the type of blade chosen by the user. With the help of A4988 driver, it is a driver to run the stepper motor, which tilt or rotate the stepper motor to the angle which is specified in the code by the user, according to our project the stepper motor is get rotates to 180° degree for every request from the user. This module is framed based on the simple ideology that, we can control the cutter from certain distance i.e. within the specified range and we can change the blade without any difficulty i.e. it reduces the manual changing of blade.

HC-05	ARDUINO UNO
GND	GND
VCC	5V
TX	Digital Pin 0(RX)
RX	Digital Pin 1(TX)

Table 4.1 HC-05 ARDUINO PIN Configurations

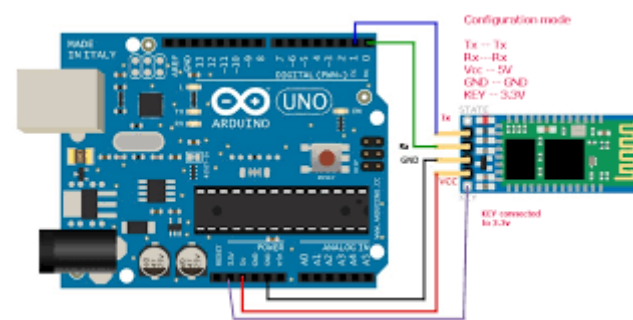


Figure 4.1 HC-05 Arduino Pin Diagram

4.3 STEPPER MOTOR AND A4988 DRIVER

This Module 3 acts as the “Blade Changing Module”. It deals with changing the type of blade according to the request from the user through the mobile android application and the data is received through the Bluetooth module. This Bluetooth module helps us to receive the data from the mobile application and transmit the data to the Arduino. Usually, the stepper motor cannot be operated without a driver circuit. The driver used to operate the stepper motor is “A4988” circuit. The A4988 is a micro-striding driver for governing the stepper motors, it is incorporated with the interpreter for the tranquil process. This motor driver offers five, unlike step tenacities which are, 1. Complete Step 2. Half (1/2) Step 3. A quarter (1/4) Step 4. Eight (8th) Step and 5. 16-Step. The Table 4.2 illustrates the connection of Stepper Motor with the A4988 Driver.

Stepper Motor	A4988
A	1B
B	2A
C	1A
D	2B

Table 4.2 STEPPER MOTOR A4988 DRIVER Connections

Stepper motor plays a vital role in stepping or rotating the shaft to various angles. To implement our blade changing idea this stepper motor and its driver helps us to discover it. In this module the stepper motor holds the twin blade on his shaft. These twin blades are mounted on the shaft in a ‘T’ like structure. The power supply to the Driver is between 8V-35V. The stepper motor gets activated when the user chooses the type of blade on the mobile application. After choosing the blade the Bluetooth module receives the data and transmits to the Arduino. Then, the Arduino checks the condition provided in the

uploaded code using the received data. If the condition is “TRUE”, then the Stepper motor get activates and rotates to 180° degree, based on the blade chosen. The Stepper motor is controlled only through the A4988 Driver and it only provides the power to the Stepper motor. This feature helps in improving the efficiency and reliability of the proposed system. The Table 4.3 and Figure 4.3 illustrate the connection of Stepper Motor with the A4988 Driver.

A4988	ARDUINO
DIR	4
STEP	5
EN	6
GND	GND
VCC	5V

Table 4.3 A4988 DRIVER ARDUINO Pin Configuration

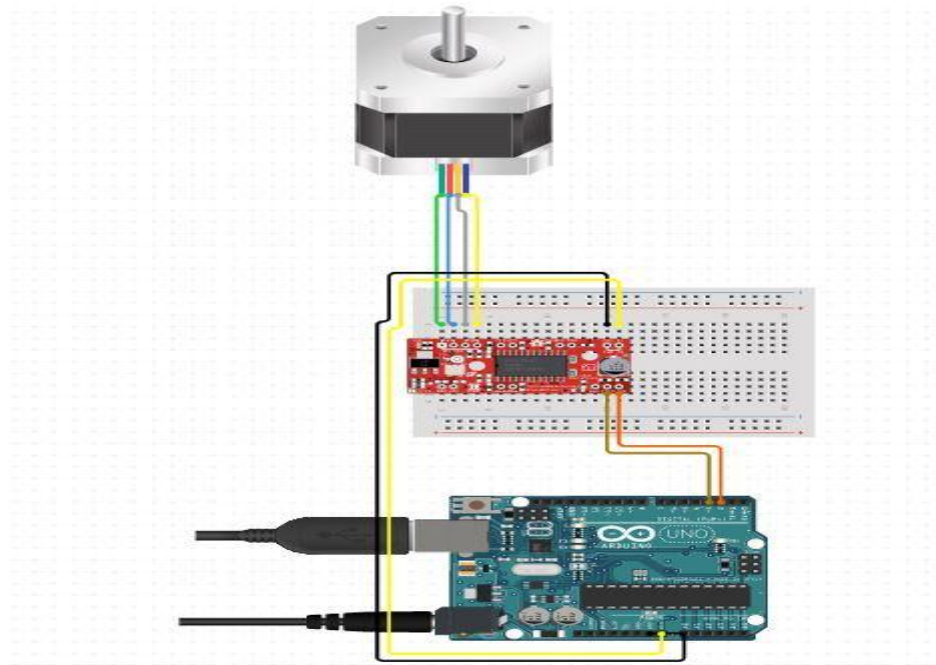


Figure 4.3 A4988 DRIVER ARDUINO Connections

4.4 CUTTING THE VEGETABLE

Final module of digital vegetable cutter is “Cutting the vegetable”. Once the vegetables are loaded into the cutting platform, then the user click the “START” button from the mobile application. After clicking the “START” button, the Bluetooth module receives the data from the mobile app and that data is transmitted to the Arduino. According to the condition provided in the coding the Arduino activates the necessary components. If the received data satisfies the condition, then the “Direction Control Valve (DCV)” get activates. Once the Direction Control Valve (DCV) receives the signal it passes the air to the one way of “Pneumatic Cylinder” and the piston is forced or expands. The air which is supplied to the pneumatic cylinder is from the Air Compressor. From which the air pressure is also been regulated based on the nature of a vegetable. Another valve in the Pneumatic cylinder is to exhaust, the piston reciprocating linear movement.

<i>DCV</i>	<i>ARDUINO UNO</i>
GND	GND
VCC	3.3v
RX	Digital Pin 1
TX	Digital Pin 2

Table 4.4 DCV-ARDUINO Connections

A pneumatic cylinder is a cylindrical metal machine that guides a piston in a straight-line reciprocating movement in a cylinder. The air converts heat energy into mechanical energy through expansion in the engine cylinder, and the gas receives piston compression in the compressor cylinder to increase the pressure. At last, the vegetable which is placed in the cutting platform is been chopped into the shapes which is preferred or required to the user.

4.5 SUMMARY

These three modules make up the Twin Blade Digital Vegetable Cutter. It gives the vegetable cutter the ability to communicate wireless among the devices. Digital vegetable cutter will be spontaneous in action and also it will ensure that durability, efficiency and good performance of the system that reaches the victim. System is implemented as described in this chapter. And also the interconnection of the modules can be understood from this chapter. The work of each module is briefed along with the connection details and with proper workflow. The work of each module appears to be sequential. The minimum time for the entire process to complete after a vegetable is loaded will be 2 to 4 minutes.