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DTMF Controlled Robot for Spraying Pesticides

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ABSTRACT: The main objective of designing this robot is simplyto facilitate the farmers in the future for agriculture purposes. Inthe present scenario, there are many recent developments in the field of robotics and agriculture on a large scale. In this paper, weare using both technologies. The methodology used in this paper is DTMF (Dual Tone Multi-Frequency). Our robot is controlled by a cell phone, through this we can make our machine communicate on a large scale over a large distance. This will help the farmer to control his agricultural works from a far distance without going into the field with easy control. This robot has several advantagesas well as important features such as automatic avoiding obstaclesin its way, and automatic metal detection in its way. It can sense soil moisture according to which the machine will irrigate the field. It can also sow seeds in the field, remove the compost from the field as well as can control the pests with a spraying facility asper the commands given by the farmer. As a result, This machinecan also be used to reach the places where farmers make harder efforts for farming such as hill areas, mountains, etc. where land is not plane. This is how we can use this robot in different fields as well as for research purposes by further manipulation in programming it can be modified accordingly.

KEYWORDS: Analog to Digital Converter (ADC); Pest Control; Automatic Irrigation system; Relays; obstacle avoidance; metal detection; easyness in agriculture technology

I.INTRODUCTION

Agriculture has played a pivotal role in the evolution of human civilization. The past century has witnessed significant transformations in agricultural practices, driven by advancements in technology and the globalization of agricultural markets. These changes have spurred innovations in agricultural techniques, including the integration of robotics.
Robotics, a field of technology focused on the design, construction, and operation of robots, as well as the development of computer systems for their control and feedback mechanisms, has made substantial contributions to modern agriculture. While agricultural robots may not resemble humans in appearance or behavior, they are tailored to meet the specific needs of farming operations.
Intelligent systems with diverse functionalities are increasingly in demand across various technological domains, including agriculture, to address the evolving needs of society. Our research highlights the benefits of automation in key agricultural tasks such as seed sowing, pest control, obstacle avoidance, and soil moisture detection. Moreover, our system enables remote control via a cell phone, allowing farmers to communicate with and operate the farming machinery over long distances, provided there is network connectivity.

Agriculture has been instrumental in shaping human civilization throughout history. In recent times, significant advancements in agricultural practices have been driven by technological progress and the globalization of agricultural markets. These advancements have led to the adoption of innovative agricultural techniques, including the incorporation of robotics.

The field of robotics, dedicated to the design, construction, and operation of robots, along with the development of computer systems for their control and feedback mechanisms, has revolutionized modern agriculture. Although agricultural robots may not resemble humans in appearance or behavior, they are specifically designed to address the unique requirements of farming operations.

The demand for intelligent systems with diverse functionalities is on the rise across various technological domains, including agriculture, to meet the evolving needs of society. Our research underscores the advantages of automation in critical agricultural tasks such as seed sowing, pest control, obstacle avoidance, and soil moisture detection. Furthermore, our system offers remote control capabilities via a cell phone, enabling farmers to communicate with and manage farming machinery from remote locations, provided there is network connectivity.

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II. OVERVIEW OF THE TECHNOLOGY USED

DTMF Description

DTMF, short for Dual-Tone Multiple Frequencies, is a method used for encoding telephone keypad digits by generating a composite audio signal composed of two tones within the frequency range of 697Hz to 1633Hz [6]. Its coding can be represented by the following formula:

$$f(t) = Aa * \sin(2\pi Cat) + Ab * \sin(2\pi Cbt) \text{ ---------- } (1)$$

In equation (1), the two terms correspond to the low and high-frequency components. Here, Aa and Ab represent the amplitudes of the low and high-frequency components, respectively. The ratio of their amplitudes is denoted by K, with a range of $0.7 < K < 0.9$:

$$K = Ab / Aa \text{ ----------------- } (2)$$

The DTMF keypad is designed so that each row and column corresponds to a unique tone frequency. Below is a depiction of a standard DTMF keypad along with the associated row/column frequencies. When any key, such as "1," "2," "*", "#," etc., is pressed, a specific code is transmitted. This code comprises two frequencies, one being a higher frequency and the other a lower frequency (refer to Fig 1).

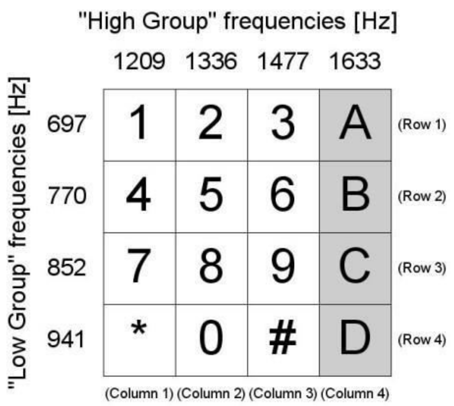

Fig. 1 DTMF Keypad Layout

When a DTMF code is received on a mobile phone, it can be heard audibly through the speaker. Therefore, the speaker output can be utilized for decoding this DTMF code. The speaker output is connected to an IC MT8870, which serves as a DTMF decoder IC. This IC is commonly used for decoding DTMF codes. It provides a 4-bit digital output represented by Q1, Q2, Q3, and Q4, corresponding to the received key.An MT8870 series DTMF decoder is employed in this setup. When the input signal applied to pin 2 (IN) in a single-ended input configuration is detected as valid (refer to Fig. 3), the correct 4-bit decode signal corresponding to the DTMF tone is transmitted to the port pins of the microcontroller.

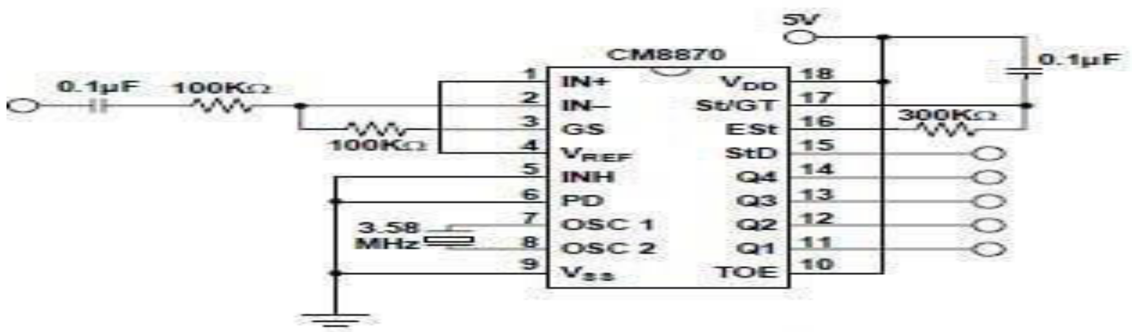

Fig. 2 Connection Diagram for MT8870

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III. PROPOSED ARCHITECTURE

A block diagram of the agricultural system depicts the Microcontroller 89S52 as its core component, interfacing with various sensor units, a water pump through relays, a pest control unit, a DTMF decoder, and a motor drive to operate the robot's motors. Upon supplying a 5V power to the system, and upon receiving a call from the user's cell phone via an earphone, the farmer must press "*" to activate the system. Subsequently, the LED connected to PORT 2 illuminates, signaling that the system is ready for operation.

Once activated, the robot executes commands entered by the user via the keypad, such as moving forward (command '2'), turning left ('4'), turning right ('6'), moving backward ('8'), and stopping ('5'). An IR Sensor is connected to the "INT1" pin, while a Metal detector is connected to the "INT0" pin of the 89S52 Microcontroller. For instance, if the robot detects an obstacle while moving forward, it halts, turns right, and resumes movement. Similarly, if a metal object is detected, an interrupt is triggered, activating a buzzer connected to Pin 3.0 of the microcontroller.

Moreover, the microcontroller interfaces with various agricultural units via PORT 2 through a 3:8 decoder and relays. For instance, pressing "1" on the keypad activates the water pump for irrigating the land, "3" activates the composting unit, "9" triggers the seed-sowing unit for pest control via pesticide spraying, and "7" activates the pest control unit to prevent pests from damaging crops. This is also an intelligent system that includes a soil moisture sensor which will indicate whether the soil is wet or dry and according to this data, the PUMP will turn ON or OFF

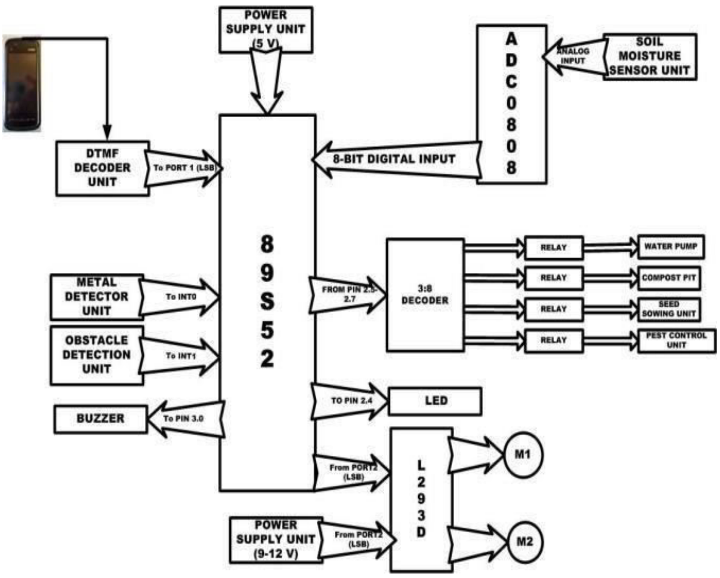

Fig-3 block diagram

This is how this robot works. We have drawn this Block Diagram (Fig. 5) and this process Flowchart using Microsoft Visio software. B. Power supply

To power the entire system, we have implemented a voltage regulator known as the 7805 regulator, depicted in Fig. 8. This regulator converts higher voltages to a stable 5V supply, ideal for operating the microcontroller and other modules. Additionally, for the voltage supply required by the DC motors, we have utilized a 7812 Voltage Regulator IC to provide a steady 12V output, as shown in Fig. 9.

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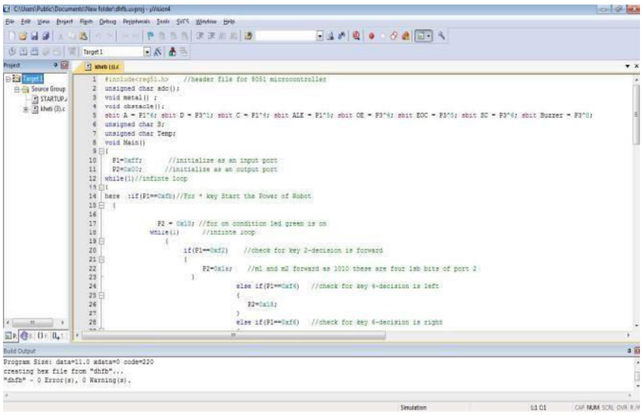

Fig. 4 Simulation of Code in µVision4 software

APPLICATIONS AND FUTURE SCOPE

A. Agricultural use

This robotics agricultural machine is designed to help thefarmers ease their work and increase productivity with its multitasking working features such as an automaticirrigation system, automatic pest control unit, automatic compost spraying, etc.

B. Pick and Place Arm

This robot can be modified by attaching a robotic arm that will pick up and place the garbage in the field in the back carrier box. In the process of picking an object, one arm will be constant, and the other arm will move. This other arm grasps the garbage and picks it up. For this purpose motors of 100r.p.m, and 30r.p.m will be used to control and move the arm and it will work according to theinstruction it got from the microcontroller. If yes then the arm will move 180 degrees upwards and keep the object inthe carrier box. This takes place with the help of a motor that will move the robotic arm through a rod all control andinstruction are under the Microcontroller.

C. Temperature and Humidity Measurement:

Temperature and Humidity measurement units can also be implemented in this farming machine in the future whichwill measure the temperature and humidity of the surroundings and will be displayed on an LCD connected to the machine.

V. CONCLUSION

By developing this robotic vehicle equipped with versatile agricultural features, we have addressed the challenges faced by farmers in cultivating their land throughout the year, regardless of the prevailing weather conditions. Moreover, the extensive range of this machine allows remote control from anywhere globally, leveraging DTMF technology. The primary advantage of this robot lies in its ability to streamline farming tasks and enhance productivity through its multifunctional capabilities. Considering its adaptability to diverse scenarios, the robot, equipped with various sub-modules, holds significant potential for agricultural and remedial purposes worldwide. This potential is particularly relevant in countries like India, where agriculture serves as the primary livelihood for a substantial portion of the population.

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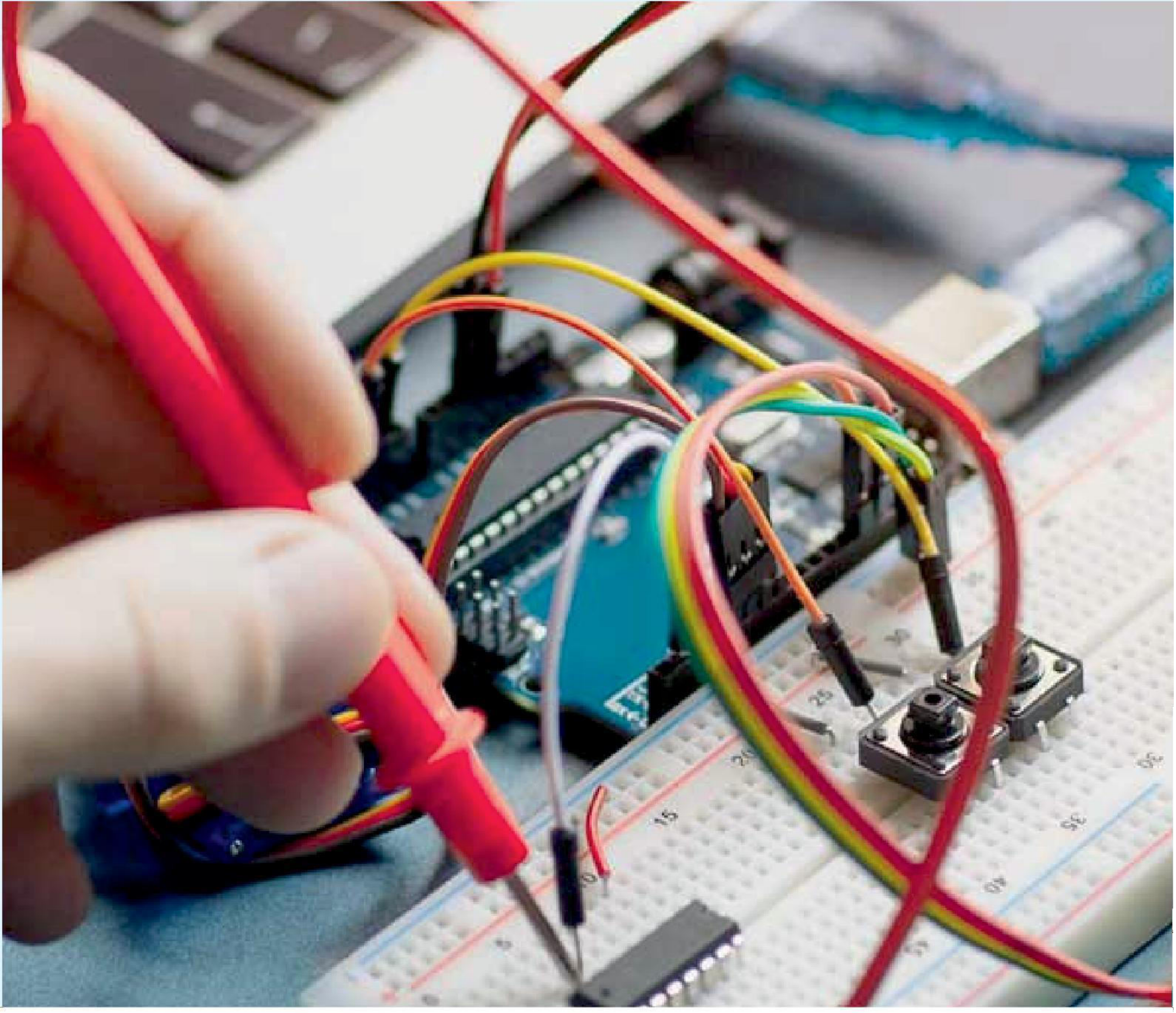

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