Research Article

DTMF BASED INTELLIGENT FARMING ROBOTIC VEHICLE

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A R T I C L E   I N F O

A B S T R A C T

The main objective of designing this robot is simply to facilitate the farmers in the future for agriculture purposes. In the present scenario, there are many recent developments in the field of robotics and agriculture on a large scale. In this paper we are using both the 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 in the field with an easy control. This robot has a number of advantages as well as important features such as automatic avoiding obstacles in its way, automatics 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 spraying facility as per the commands given by the farmer. As a result, This machine can 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 purpose by further manipulation in programming it can be modifiedaccordingly.

INTRODUCTION

Agriculture was the key development in the rise of human civilization. A remarkable change in agricultural practices has occurred over the past century in response to new technologies, and the development of world agricultural markets. This also has led to technological improvements in agricultural techniques. Robotics is the branch of technology that deals with the design, construction, operation, and application of robots, as well as computer systems for their control, sensory feedback, and information processing. The design of a given rover will often incorporate agricultural efforts, though it may not look much like a human being or function in a human like manner. These types of intelligent systems having robust and feasible model with a number of integrated functionalities is the demand of future in every field of technology, for the betterment of the society.

Earlier efforts include the work of Jagannathan Kanniah, who eveloped an obstacle avoidance mobile robot [1] with an inevitable accent towards the game version. Venkata Naga Rohit Gunturi, who worked on the development of Micro Controller Based Automatic Plant Irrigation System [4]. Yun Chan Cho, who worked on developing a Remote Robot Control System based on DTMF of Mobile Phone [3] using CDMA external module, for varying the speed of the robotic vehicle. G. Rajesh [2], developed Microcontroller Based Drip

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Irrigation System. R. Suresh, S. Gopinath, K. Govindaraju, T. Devika, N. SuthanthiraVanitha, developed a GSM based [7] Automated Irrigation Control using Rain gun Irrigation System.

N.K. Tyagi [6], worked on the Design and development of an auto irrigation system. Our work provides the advantages of automation in seed sowing, pest control, obstacle avoidance, soil moisture detection as well as robust control by a cell phone, through this we can make this farming machine communicate from a very large distance provided there must be network connection in cell phone due to its wider range as large as the coverage area of the service provider, also no interference with other controllers and up to twelve controls. So this system will be a powerful and flexible tool that will offer this service at any time, and from anywhere with the constraints of the technologies being applied. Conventionally, wireless- controlled robots use RF circuits, which have the drawbacks of limited working range, limited frequency range and limited control. Use of a mobile phone for robotic control can overcome these limitations.

In this manuscript, we are controlling this rover through a wireless communication system using DTMF technology. As the system is supplied with 5V and the call is made to the robot, the user is required to press "*" key to turn ON the machine.Accordingtothebuttonpressedi.e."2","4","6","8"   on the transmitting phone, the rover will move front, left right and

back respectively. But if any obstacle is sensed by the robot,it will change its direction).This is also an intelligent system which includes soil moisture sensor which measures the dryness of the soil, metal detector which will indicate the metal in the field by turning ON the buzzer. Also, this machine is an integration of various further agricultural units such as seed sowing, water irrigation, and compost and pestcontrol.

Overview of the Technology used

DTMF Description

DTMF stands for dual tone multiple frequencies. DTMF generation is a composite audio signal of two tones between the frequency of 697Hz and 1633Hz [6]. Its coding definition can be expressed as:

$$f(t)=A_{a}\sin(2C_a t)+A_{b}\sin(2C_b)t \qquad ...(1)$$

In the formula (1), the two terms separately express the Values of low and high voice frequency. Aa and Ab respectively indicate the sample quantization baseline of tone cluster of low voice frequency and high voice frequency, and the ratio of theiramplitudeis:

$$K=Ab/Aa(0.7<K<0.9) \qquad ...(2)$$

The DTMF keypad is arranged such that each row will have its own unique tone frequency and also each column will have its own unique tone. Below is a representation of the typical DTMF keypad and the associated row/column frequencies. When any of the key like "1", "2", "*", "#" etc. is pressed particular code is transmitted. This code is consist of two frequency among which one is higher frequency and second one is lower frequency (seeFig1).

Fig 1 DTMF Keypad Layout

When any DTMF code has been received at mobile phone it can be audible through speaker. So to decode this DTMF code speaker output itself can be used. Output of speaker is connected to IC MT8870 which is DTMF decoder IC. It used widely to decode DTMF code. It gives 4-bit digital output Q1; Q2, Q3, and Q4 according to the received key (see Fig.2).

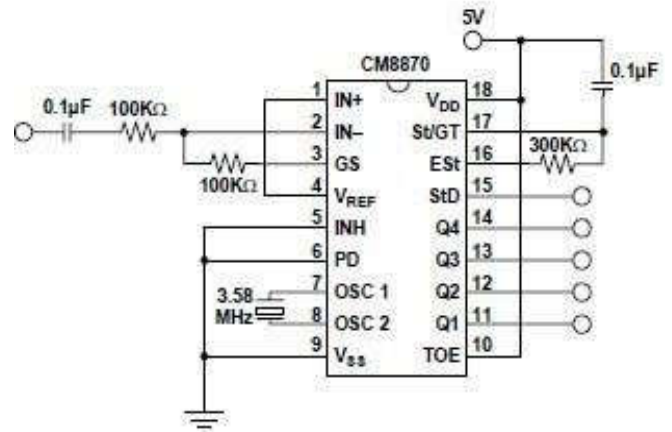| Digit	TOE	INH	ESt	Q4	Q3	Q2	Q1
ANY	L	X	H	Z	Z	Z	Z
1	H	X	H	0	0	0	1
2	H	X	H	0	0	1	0
3	H	X	H	0	0	1	1
4	H	X	H	0	1	0	0
5	H	X	H	0	1	0	1
6	H	X	H	0	1	1	0
7	H	X	H	0	1	1	1
8	H	X	H	1	0	0	0
9	H	X	H	1	0	0	1
0	H	X	H	1	0	1	0
*	H	X	H	1	0	1	1
#	H	X	H	1	1	0	0
A	H	L	H	1	1	0	1
B	H	L	H	1	1	1	0
C	H	L	H	1	1	1	1
D	H	L	H	0	0	0	0

**Fig 3** Connection Diagram for MT8870

An MT8870 series DTMF decoder is used here. When the input signal given at pin 2 (IN) in single-ended input configuration is recognized to be effective (see Fig. 3), the correct 4-bit decode signal of the DTMF tone is transferred to port pins of Microcontroller.

Proposed architecture

Block Diagram and description

Microcontroller 89S52 is the heart of this agricultural system which is interfaced with various sensor units, water Pump through relays, pest control unit, DTMF Decoder and a motor drive to drive the motors of the robot. When the power supply of 5V is supplied to the system and as soon as the user will call on the cell phone attached with the machine through an earphone, the farmer will have to press "*" to turn ON the system and the LED connected at PORT 2 will glow indicating that the system is ready. When the system is turned ON, the robot will follow the commands as the user enters on the keypad such as '2' for moving forward, '4' for turning left, '6' for turning right, '8' for moving backwards and '5' to stop the movement. IR Sensor is connected to the "INT1" pin, Metal detector is connected to "INT0" pin of 89S52 Microcontroller. Now suppose for an instance, The robot is moving forward and it senses an obstacle in front of it, it will immediately stop there, turn right and move or suppose it senses any Metal in the field, Interrupt is generated and as the interrupt is generated the buzzer will get ON which is connected to Pin 3.0 of the microcontroller. Microcontroller is also connected with various agricultural units at PORT 2 through a 3:8 decoder and relays such as Water pump for irrigating the land when "1" is pressed on the keypad, Composting unit for composting the farming land when "3" is pressed on the keypad, Seed sowing

unit for sowing seeds when "7" is pressed, Pest control unit for preventing the crops from pests by spraying pesticides when "9" is pressed on the keypad. This is also an intelligent system which includes 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.
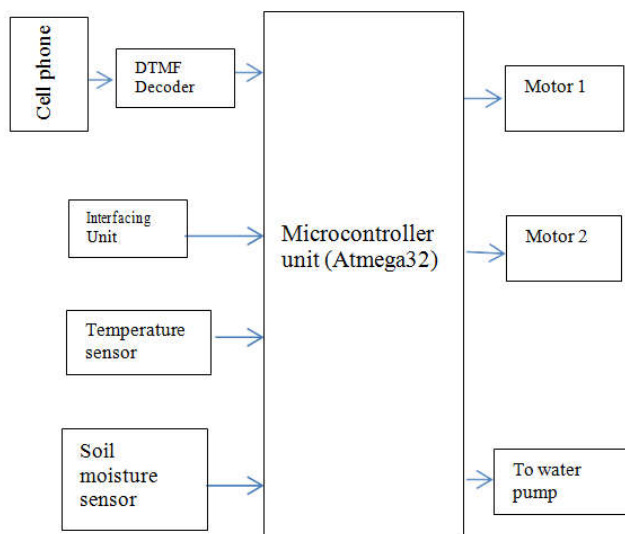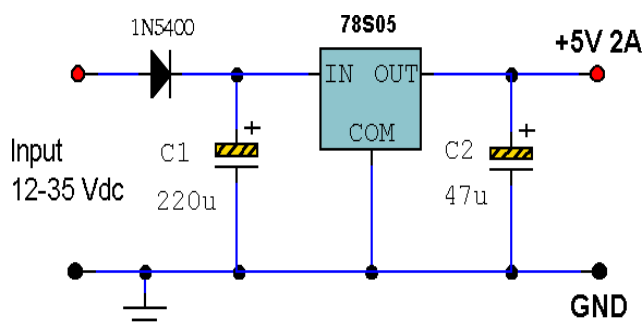

Power supply

Fig 6 Power Supply5V

For the power supply to the whole system, we have used a regulator called voltage regulator 7805 which converts the higher voltage to 5 V (Fig. 8) which is the desired supply to operate microcontroller and the modules. For the voltage supply of DC motors, we have used 7812 voltage regulator IC to get 12V for running the motors (Fig.9).
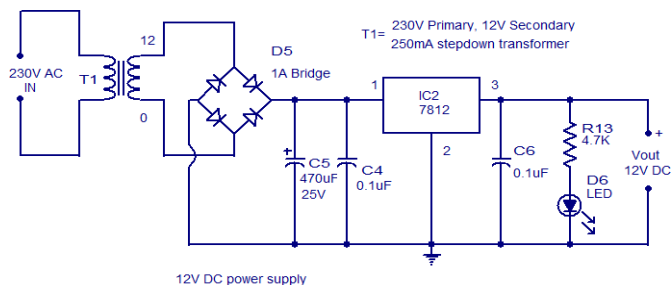

Fig 7 Power Supply 12V

Motor Driver

Robot Chassis is the major platform of the Robot Vehicle, which is connected with a mobile using DTMF circuitry. A cell phone is connected to the vehicle through a 3.5mm audio jack (as shown in fig. 6), receives call from the calling subscriber. According to the generated DTMF frequencies from the cell phone, the caller can control the robotic

movement. IC L293D is designed in such a way to control two geared DC motors which takes command from the DTMF decoder through a Microcontroller. H-Bridge circuit is as shown in fig.10below.
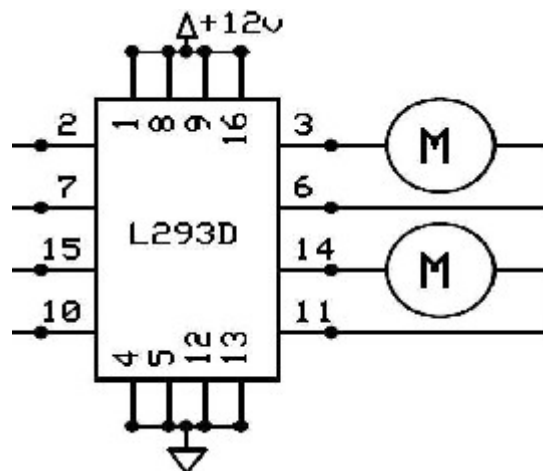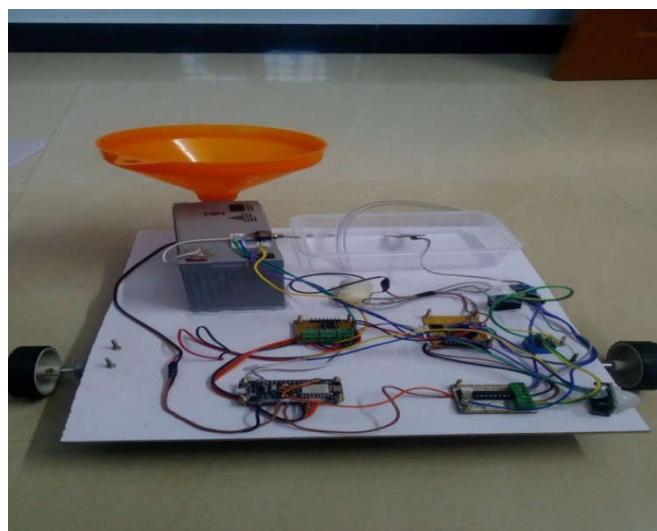

Fig 8 H-bridge circuit

Fig 9 Hardware Kit for Total Project

Applications and Futurescope

Agricultural use

This robotics agricultural machine is designed to facilitate the farmers to ease their work and increase the productivity with its multitasking working features such as automatic irrigation system, automatic pest control unit, automatic compost spraying etc.

Pick and Place Arm

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

Temperature and Humidity Measurement

Temperature and Humidity measurement units can also be implemented to this farming machine in future which will measure the temperature and humidity of the surrounding and will be displayed on a LCD display connected to themachine.

CONCLUSION

By developing this robotic vehicle with its multi-tasking agricultural features, we have overcome the difficulty of farmers in farming their land in every season no matter what is the weather that day also this has a large range as this machine can be controlled from anywhere in the world just using this DTMF technology. The main advantage of this robot is that it is that it facilitates the farmers to ease their work and increase the productivity with its multitasking working features. Considering all the situations, the robot integrated with different sub modules can be used for redemption and agricultural purposes worldwide especially countries like India where agriculture provides the principal means of livelihood for the major Indian population.

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