SOLAR TRACKING BASED UNDERGROUND SPREADED AGRICULTURAL SYSTEM

Alka Negi[1], Amritanshu Srivastava[2], Shreya Srivastava[3], Utkarsh Srivastava[4]

[1,3,4] *Electronics and Communication Engineering, MJP Rohilkhand University, (India)*

[2] *Electronics and Communication Engineering, Shri Mata Vaishno Devi University,(India)*

ABSTRACT

The objective of this farming architecture is to facilitate aid to farmers for effective distant farming. In the present scenario, wide variety of embedded systems are prevalent that aims to benefit the farmers and this research is an attempt to contribute in this field. The methodology used here is DTMF implementing which a mobile phone oriented machine is designed to control the activities to be performed in the farming land located far off. Solar energy is used for power supply to the machine which puts down the maintenance cost of the system. The machine improvises features like soil moisture detection, humidity sensing, fire or smoke detection. A network can be established through which user can sense soil moisture according to which the machine will irrigate the field. It can also manure the field as well as can control the pests with spraying facility on a single click of button. The machine also performs metal detection and human sensing. The GSM module is further integrated with the system to transmit notifications to the user to keep him aware of the events taking place in the field. Hence, this machine can prove to be a boon for farming in the hilly, mountainous terrain where farmers have to make harder efforts for cultivation.

Keywords: DTMF, GSM Module, Irrigation, Solar Powered, Ultrasound Sensor,Underground System

I. INTRODUCTION

Agriculture is humankind's oldest and still most important economic aspect. It was the key development in the rise6 of human civilization. Over past centuries, many remarkable change occurred in response to new inventions and technologies which had led to technological improvements in agricultural techniques. The design of a given system will often incorporate agricultural efforts. These types of intelligent systems having feasible model with a number of integrated functionalities is the demand of future in every field of technology, for the betterment of the society.

Various efforts have been made for the improvement of technology used in farming practises for cultivation which include the work of Juan Francisco Villa-Medina, who developed an Automated Irrigation System Using a Wireless Sensor Network and GPRS Module [1]. Mahir DURSUN, who worked on the development of Application of Solar Powered Automatic Water Pumping in Turkey [4]. SatyaPrasanthYalla, who worked on developing Energy Management in an Automated Solar Powered Irrigation System [3]. N.N.Kasat [2], developed Automated Solar Based Agriculture Pumping.

Our work provides the advantages of controlling the whole undergrounded system by a mobile phone as well as automation in irrigation, soil moisture detection 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, RF circuits have the drawbacks of limited working range, limited frequency range and limited control. Use of a mobile phone can overcome these limitations.

In this manuscript, our machine can be controlled by a cell phone using DTMF technology without going to the agricultural field and hence helps in increasing the productivity. This machine has a number of advantages as well as important features like metal detection, soil moisture detection and humidity sensor according to which it will give the command for irrigation. It can also be used for manuring the field. This is also an intelligent system which is also a major advantage of this system that solves the problem of protecting our agricultural land from fire and animals or thieves by giving SMS alerts to the owner for which we have interfaced GSM module.

II. OVERVIEW OF THE TECHNOLOGY

DTMF stands for dual tone multiple frequencies. DTMF generation is a composite audio signal of two tones between the frequency of 697Hz and 1633Hz [5]. Its coding definition can be expressed as:

$$f(t)=A\_\{\ a\ \}\sin(2C\{\ a\}t)+A\ \_\{b\ \}\sin(2C\{b\ \}t) \quad \text{-------} \quad (1)$$

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 their amplitude is:

$$K=Ab/Aa\ (0.7<K<0.9) \quad \text{----------} \quad (2)$$

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(see Fig 1).

Hz	*1209*	*1336*	*1477*	*1633*
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	*	0	#	D

Fig1. DTMF Touch Tone Keypad

III. PROPOSED ARCHITECTURE AND WORKING

3.1 Block Diagram and its Description

Microcontroller 89S52 is the heart of this underground agricultural system which is interfaced with various sensor units, water Pump through relays, pest control unit, DTMF Decoder, Human sensor to detect thief or

animal entering the field and GSM module to SMS the owner. In this system we have used solar power and battery to store power. When the power supply of 5V after conversion is supplied, the system will turn ON and the LED connected at PORT 3 will glow indicating that the system is ready. When the system is turned ON, all the sensors will become active. Fire/Smoke Sensor is connected to the "INT1" pin, Metal detector (Fig 2) is connected to "INT0" and Human Sensor is connected to "TIMER0" pin of 89S52 Microcontroller. Now suppose for an instance, any person or animal enters the field, the human sensor will detect it and TIMER0 interrupt occurs, the microcontroller will immediately send the command to GSM module and the owner will get the SMS 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 and again SMS will be send to the owner. There is a soil moisture sensor and Humidity sensor which we have interfaced with Microcontroller through ADC0808 which will give the Digital data to Microcontroller and Microcontroller will give the command to GSM module and SMS to owner that "Irrigation needed", then owner will press"1" to start the water pump for irrigation. Pest control unit for preventing the crops from pests by spraying pesticides when "9" is pressed on the keypad. When "7" is pressed on the keypad, system will start manuring the field.

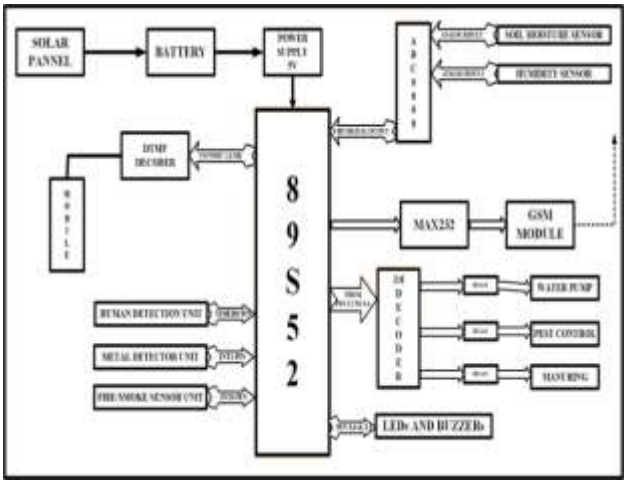

Fig 2. Block Diagram

3.2 Flowchart

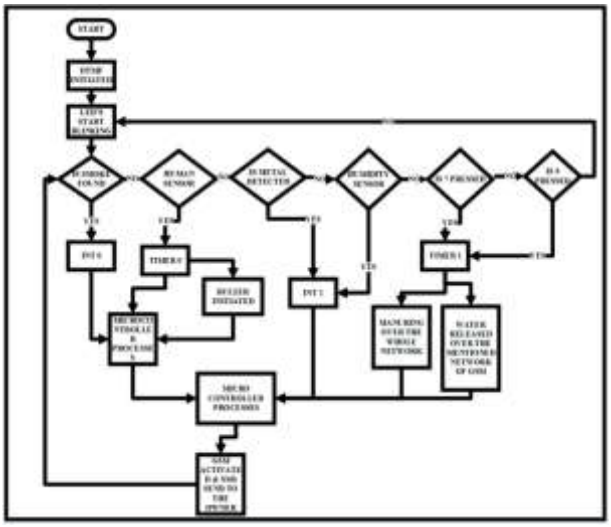

Fig 3. Flowchart

3.3 Algorithm of Process Flow

STEP 1: A power supply of 5V is supplied to the system after conversion (from solar energy). The LED connected at PORT 3 will glow indicating that the system is ready and all the sensors become active.

STEP 2: When the mobile holder at a different location presses a key from the DTMF keypad, signal of particular frequency is generated.

STEP 3: The signal is received by the mobile in the agricultural field.

STEP 4: The received signal is transmitted via an earphone to the input of the DTMF decoder MT8870.

STEP 5: The decoder generates a 4-bit output corresponding to the frequency of its input signal.

STEP 6: This decoded output is the input to microcontroller 89S52 which performs various functions depending on its input*.

STEP 7: Fire/Smoke Sensor is connected to the INT1 pin.

STEP 8: Metal detector is connected to INT0.

STEP 9: Human Sensor and metal detectors are connected to TIMER0 pin of 89S52 microcontroller which is configured to be used for interrupt generation.

STEP 10: LEDs and buzzers are connected to Port3.0 of the microcontroller to indicate the occurrence of various events.

STEP 11: Whenever an interrupt is generated a command is sent to the GSM module which informs the owner about the event through SMS with an indication at Port3.0 by the glow of LED or sound of buzzer.

STEP 12: A soil moisture sensor and humidity sensor have been interfaced with microcontroller through ADC0808.The digital data form it is sent to the microcontroller and it generates appropriate command for the GSM module to send SMS to the owner.

*If irrigation is needed, then owner will press"1" to start the water pump for irrigation.

*For pest control pesticides can be sprayed when "9" is pressed on the keypad.

*When "7" is pressed on the keypad, system will start manuring the field.

3.4 GSM Module

In this unit (Fig 4), I have interfaced a GSM module with Microcontroller with programming in such a way so that it will send a SMS to the caller. In this scheme RTS and CTS signals of serial port interface of GSM Modem are connected with each other. The transmit signal of serial port of microcontroller is connected with transmit signal (TxD) of the serial interface of GSM Modem while receive signal of microcontroller serial port is connected with receive signal (RxD) of serial interface of GSM Modem.

Fig 4. GSM Module

The AT commands which we have used for transmitting SMS to owner's mobile are:

3.4.1 AT Commands to Initialize the GSM Modem

- AT =>it's just to wake the modem.
- ATE0 => Echo off
- AT+CMGF=1 => Enable text mode to send SMS
- AT+CNMI=1,1,0,0,0 => Disable new message indication OFF

3.4.2 AT Commands to Send/Receive SMS

- AT+CMGF=1 =>Make SIM300 to text mode
- AT+CMGR=1 =>To read the first message
- AT+CMGS="mobile number" =>To send SMS
- AT+CMGD=1 => To delete first message
- AT+CMGD=1,4 =>To delete all messages

3.4.2.1 Human Detector Sensor

We have used Human Detection Sensor in order to detect any thief or animal entering the agricultural field. Sensor Range (When the camera is in a 20º C [68º F] environment), horizontally is approx. 30º and vertically is approx. 85º and distance is approx. 5 m (16.4 ft.).

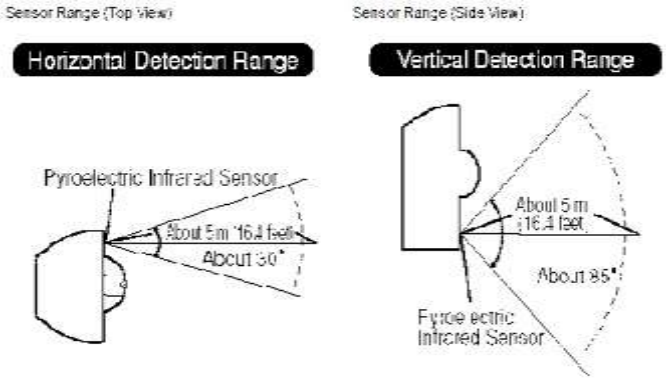

Fig 5. Sensor Range

3.4.2.2 Solar Tracker Unit

The LDR sensors are placed on the solar panel which helps in tracking maximum intensity of sunlight.

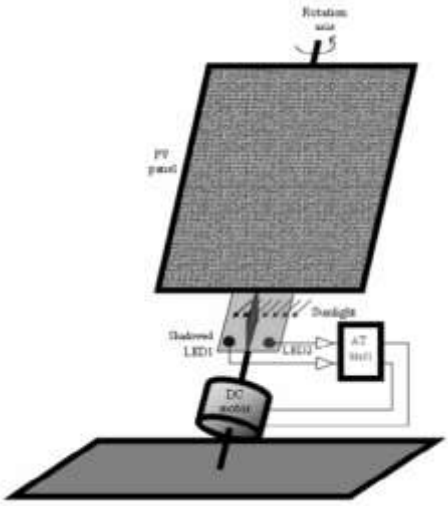

Fig 6. Solar Tracker

3.4.2.3 Prototype Design

A solar panel is a set of solar photovoltaic modules electrically connected and mounted on a supporting structure. A photovoltaic module is a packaged, connected assembly of solar cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. In the system we use 12V, 5W solar panel (Fig 7).

Fig 7. Solar Pannel Prototype

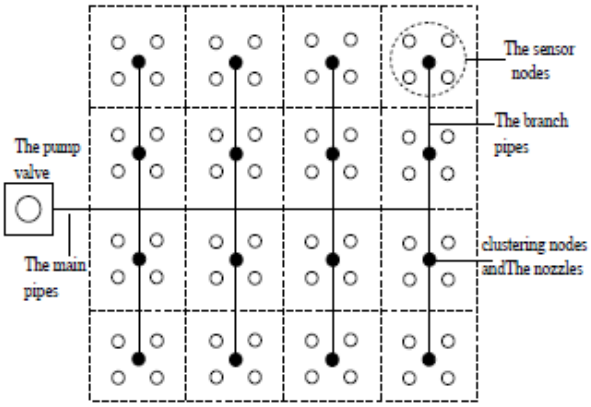

Fig 8. Land Setup Prototype

V. CONCLUSION

By developing this undergrounded Agricultural System with its multi-tasking feature, we have overcome the different limitations in the field of agriculture and farming as well as cultivation and security of the farm land by designing this system that can be controlled from anywhere in the world just using this DTMF technology. The main advantage of this undergrounded system is that it can sense human entering the field so that any other person or animals cannot enter the field. It has various sensors which will function accordingly to the software coded and send SMS to the user accordingly. Considering all the situations, the system is integrated with different sub modules can be used for redemption and security purpose.

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