# Design And Development of Farmer Friendly Agribot

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***Abstract :*** Many advances in technology have made the agriculture business a much less labor intensive industry to be a part of. If we think back even only 50 years, farmers were just beginning to incorporate technologies into their farming techniques. It has been said that individuals that are involved in the farming industry are some of the least susceptible to change. When we take a look at the farming industry now, we can see that this is rapidly changing. Farmers are looking for new ways to implement technology to cut costs and reduce labor hours. One of the ways that farmers are beginning to explore new technologies in farming come from the autonomous tractor. The RF based tractor is something that is very new to the agriculture industry, but is quickly gaining popularity from agriculture research companies around the United States. These tractors are described by Farm Industry News as a tractor that drives its solve with a computer in control. Although still in the research phase of development, autonomous tractors are rapidly becoming more of a reality than an idea. When the tractor is moving on a surface, it is controlled by a RF remote. This can be moved forward and reverse direction using geared motors of 60RPM. Also this robot can take sharp turnings towards left and right directions. This project uses AT89S52 MCU as its controller. Solar power has become one of the most popular alternative energy sources. The sun's energy is usually harvested through solar panels that are made up of photovoltaic cells. These cells can convert the sun's power into electricity that can be used for a number of purposes. The RF modules used are STT-433 MHz Transmitter, STR-433 MHz Receiver, HT12E RF Encoder and HT12D RF Decoder.

The Control switches are interfaced to the RF transmitter through RF Encoder. The encoder continuously reads the status of the switches, passes the data to the RF transmitter and the transmitter transmits the data. Regulated 5V, 750mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary 230/18V step down transformer. These modules have been carefully selected to allow the farmer better range and control over the robot in the field. To ensure maximum efficiency of the robot a solar panel is fitted on to the robot which will provide relief to the battery of the robot. Farmers today spend a lot of money on machines that help them decrease labor and increase yield of crops but the profit and efficiency are very less. Hence automation is the ideal solution to overcome all the shortcomings by creating machines that perform one operations and automating it to increase yield on a large scale.

***IndexTerms –*** Autonomous tractor, , RF based tractor, Controller, rectifier.

## I. INTRODUCTION

Agricultural robots are the fastest growing technology developed to perform various complex tasks that are difficult for humans to achieve. Recent news claims that the Japanese government has taken an initiative to use robotic operators in lands swamped by March 2011 tsunami. This "Dream project" was planned to involve unmanned tractors working in the farm on the disaster site. The robotic farmers are capable of cultivating vegetables, fruits, soybeans, wheat and rice, which are then packed in boxes and shipped across the country by this robotic technology. This process is accompanied by recycling of carbon dioxide using machinery in an attempt to reduce the use of fertilizers.

A single solution to implement precision agriculture is the development of a single gantry robot that can perform several precision agriculture related operations. The main objective of this system is to implement soil monitoring and precision irrigation on each crop, perform de-weeding and design a cultivated field using accurate robotic crop planning.

The idea of robotic agriculture (agricultural environments serviced by smart machines) is not a new one. Many engineers have developed driverless tractors in the past but they have not been successful as they did not have the ability to embrace the complexity of the real world. Most of them assumed an industrial style of farming where everything was known before hand and the machines could work entirely in predefined ways – much like a production line. The approach is now to develop smarter machines that are intelligent enough to work in an unmodified or semi natural environment. These machines do not have to be intelligent in the way we see people as intelligent but must exhibit sensible behavior in recognized contexts. In this way they should have enough intelligence embedded within them to behave sensibly for long periods of time, unattended, in a semi-natural environment, whilst carrying out a useful task. One way of understanding the complexity has been to identify what people do in certain situations and decompose the actions into machine control. This is called behavioral robotics and a draft method for applying this approach to agriculture is given in Blackmore.

The approach of treating crop and soil selectively according to their needs by small autonomous machines is the natural next step in the development of Precision Farming (PF) as it reduces the field scale right down to the individual plant or Phytotechnology (Shibusawa 1996). One simple definition of PF is doing the right thing in the right place at the right time with the right amount. This definition not only applies to robotic agriculture (RA) and Phytotechnology but it also implies a level of automation inherent in the machines. Automatic sensing and control (on-the-go) for each task is also important and many research papers have shown that these systems are feasible but most are too slow, and hence not economically viable, to be operated on a manned tractor. Once these systems are mounted on an autonomous vehicle, they may well suddenly become commercially viable.

## II. Solar Insolation And Solar Panel Efficiency

Solar Insolation is a measure of how much solar radiation a given solar panel or surface receives. The greater the insolation, the more solar energy can be converted to electricity by the solar panel. Other factors that affect the output of solar panels are weather conditions, shade caused by obstructions to direct sunlight, and the angle and position at which the solar panel is installed. Solar panels function the best when placed in direct sunlight, away from obstructions that might cast shade, and in areas with high regional solar insolation ratings.

Solar panel efficiency can be optimized by using dynamic mounts that follow the position of the sun in the sky and rotate the solar panel to get the maximum amount of direct exposure during the day as possible. For more information on solar panel efficiency through the use of mounts, see our section on solar panel mounts and accessories. Solar energy's uses are limited only by human ingenuity. A partial list of solar applications includes space heating and cooling through solar architecture, potable water via distillation and disinfection, day lighting, solar hot water, solar cooking, and high temperature process heat for industrial purposes. To harvest the solar energy, the most common way is to use solar panels.

## III. Power Supply:

The input to the circuit is applied from the regulated power supply. The a.c. input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating d.c voltage. So in order to get a pure d.c voltage, the output voltage from the rectifier is fed to a filter to remove any a.c components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage.

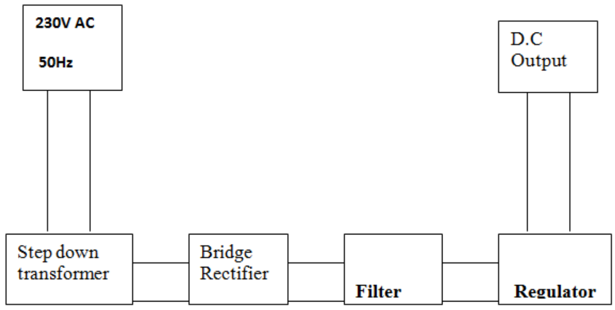


Figure 1: Power supply

### 3.1 Transformer:

Usually, DC voltages are required to operate various electronic equipment and these voltages are 5V, 9V or 12V. But these voltages cannot be obtained directly. Thus the a.c input available at the mains supply i.e., 230V is to be brought down to the required voltage level. This is done by a transformer. Thus, a step down transformer is employed to decrease the voltage to a required level.

### 3.2 Rectifier:

The output from the transformer is fed to the rectifier. It converts A.C. into pulsating D.C. The rectifier may be a half wave or a full wave rectifier. In this project, a bridge rectifier is used because of its merits like good stability and full wave rectification.

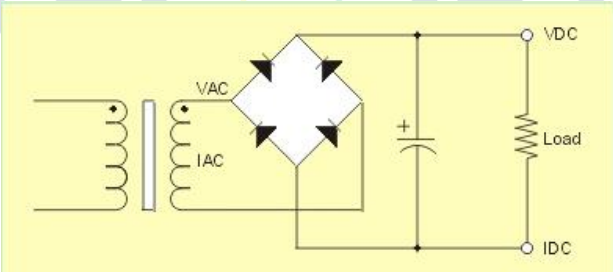


Figure 2: Bridge Rectifier

The Bridge rectifier is a circuit, which converts an ac voltage to dc voltage using both half cycles of the input ac voltage. The Bridge rectifier circuit is shown in the figure. The circuit has four diodes connected to form a bridge. The ac input voltage is applied to the diagonally opposite ends of the bridge. The load resistance is connected between the other two ends of the bridge.

For the positive half cycle of the input ac voltage, diodes $D_1$ and $D_3$ conduct, whereas diodes $D_2$ and $D_4$ remain in the OFF state. The conducting diodes will be in series with the load resistance $R_L$ and hence the load current flows through $R_L$.

For the negative half cycle of the input ac voltage, diodes $D_2$ and $D_4$ conduct whereas, $D_1$ and $D_3$ remain OFF. The conducting diodes $D_2$ and $D_4$ will be in series with the load resistance $R_L$ and hence the current flows through $R_L$ in the same direction as in the previous half cycle. Thus a bi-directional wave is converted into a unidirectional wave.

### 3.3. Filter:

Capacitive filter is used in this project. It removes the ripples from the output of rectifier and smoothens the D.C. Output received from this filter is constant until the mains voltage and load is maintained constant. However, if either of the two is varied, D.C. voltage received at this point changes. Therefore a regulator is applied at the output stage.

### 3.4. Voltage regulator:

As the name itself implies, it regulates the input applied to it. A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. In this project, power supply of 5V and 12V are required. In order to obtain these voltage levels, 7805 and 7812 voltage regulators are to be used. The first number 78 represents positive supply and the numbers 05, 12 represent the required output voltage levels. The L78xx series of three-terminal positive regulators is available in TO-220, TO-

220FP, TO-3, D2PAK and DPAK packages and several fixed output voltages, making it useful in a wide range of applications. These regulators can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each type employs internal current limiting, thermal shut-down and safe area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1 A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltage and currents.

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Radio frequency (abbreviated RF) is a term that refers to alternating current (AC) having characteristics such that, if the current is input to an antenna, an electromagnetic (EM) field is generated suitable for wireless broadcasting and/or communications. These frequencies cover a significant portion of the electromagnetic radiation spectrum, extending from nine kilohertz (9 kHz),the lowest allocated wireless communications frequency (it's within the range of human hearing), to thousands of gigahertz(GHz).

**3.6 RF TRANSMITTER STT-433MHz:**

Factors Influenced To Choose Stt-433MHZ

- The STT-433 is ideal for remote control applications where low cost and longer range is required.
- The transmitter operates from a1.5-12V supply, making it ideal for battery-powered applications.
- The transmitter employs a SAW-stabilized oscillator, ensuring accurate frequency control for best range performance.
- The manufacturing-friendly SIP style package and low-cost make the STT-433 suitable for high volume applications.

**Its features include:** 433.92 MHz Frequency, Low Cost, 1.5-12V operation

- Small size

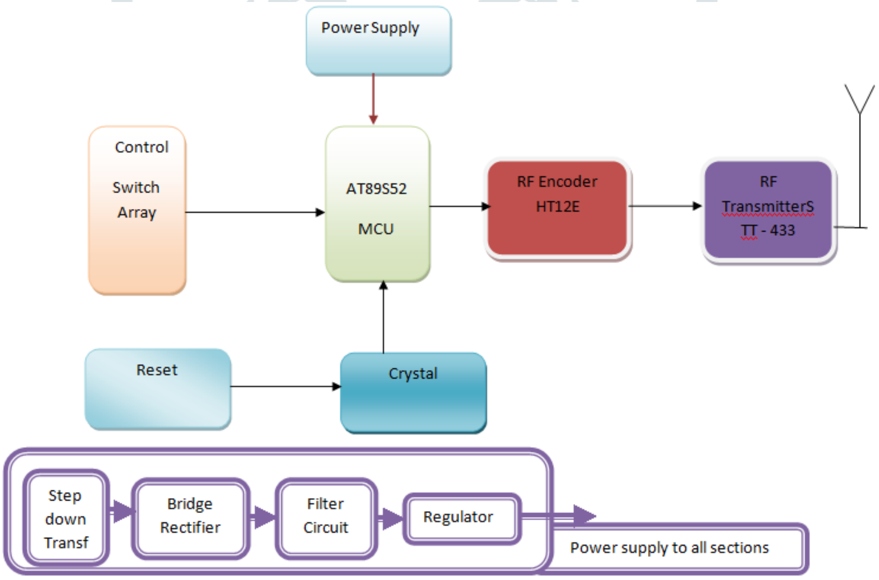


Figure 3:Block diagram of a RF Transmitter

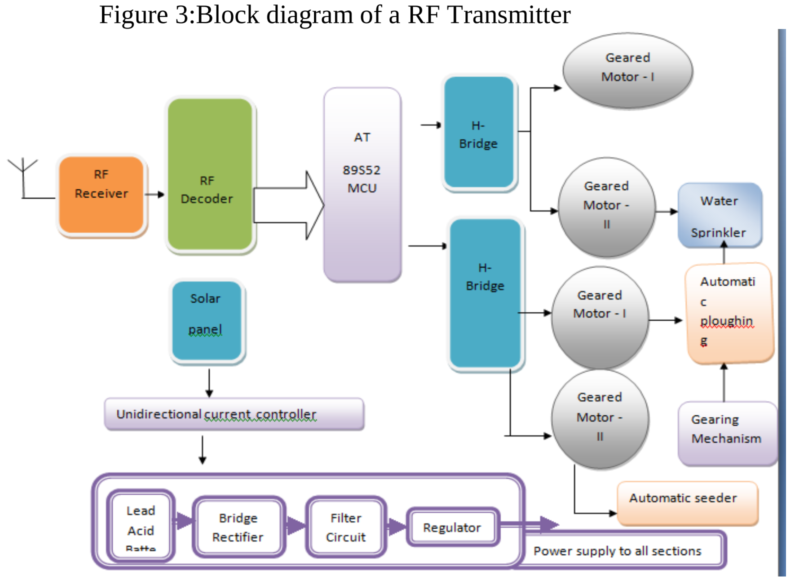


Figure 4: Block diagram of a RF Receiver

**3.7 Sprinkler Specifications:**

High pressure water pump built in thermal protector fully automatic demand pumps can be used as a portable sprinkler pump .High pressure diaphragm pump small size, light weight and stable performance. Special valve for liquid input and output; Antvibrationpad, easy installation with stable function. Self-priming, automatic pressure switch. Automatic pressure protection. Low noise, with excellent resistant to chemical corrosion; The functions include water purification, filter machine, chemical metering and fluid supply. High pressure pumps are used in sprayers and spray fixtures for high food, Beverage filling and liquid transfer. Solar energy industry clean machine, road-works equipment's, cooler system.

Table 1 : Spriinkler specification

| | |
|---|---|
| **Power:** | Electric |
| **Type:** | Diaphragm Pump |
| **Duty Cycle:** | Working Intermittent |
| **Certifications:** | CE, RoHS, ISO9001: 2000 |
| **Voltage:** | 12vdc & 115V AC( Consult Factory for Other Voltage |

Figure 5:Cosmo solar pump

The present project is implemented on Keil uVision. In order to program the device, proload tool has been used to burn the program onto the microcontroller. The features, pin description of the microcontroller and the software tools used are discussed in the following sections.

• Compatible with MCS-51® Products
• 8K Bytes of In-System Programmable (ISP) Flash Memory
– Endurance: 1000 Write/Erase Cycles
• 4.0V to 5.5V Operating Range
• Fully Static Operation: 0 Hz to 33 MHz
• Three-level Program Memory Lock
• 256 x 8-bit Internal RAM
• 32 Programmable I/O Lines
• Three 16-bit Timer/Counters
• Eight Interrupt Sources
• Full Duplex UART Serial Channel
• Low-power Idle and Power-down Modes
• Interrupt Recovery from Power-down Mode
• Watchdog Timer
• Dual Data Pointer
• Power-off Flag

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry- standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes.

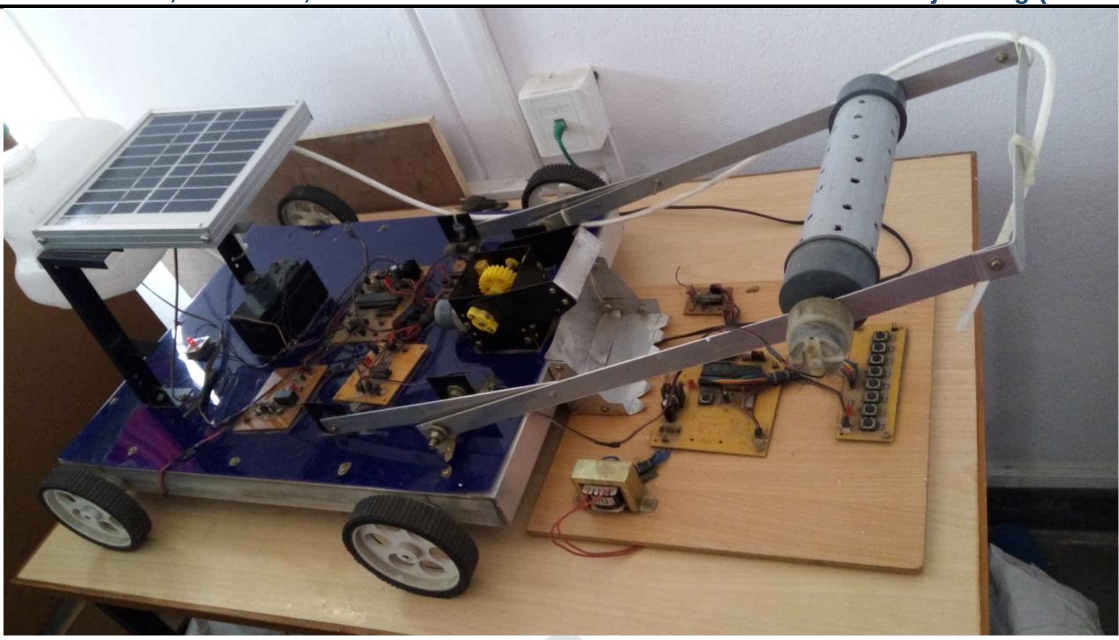

Figure 6: Farmer friendly AGROBOT

**3.8 Proload:**

Proload is a software which accepts only hex files. Once the machine code is converted into hex code, that hex code has to be dumped into the microcontroller placed in the programmer kit and this is done by the Proload. Programmer kit contains a microcontroller on it other than the one which is to be programmed. This microcontroller has a program in it written in such a way that it accepts the hex file from the keil compiler and dumps this hex file into the microcontroller which is to be programmed. As this programmer kit requires power supply to be operated, this power supply is given from the power supply circuit designed above. It should be noted that this programmer kit contains a power supply section in the board itself but in order to switch on that power supply, a source is required. Thus this is accomplished from the power supply board with an output of 12volts or from an adapter connected to 230 V AC.

**3.8.1 Steps to work with Proload:**

1. Install the Proload Software in the PC.
2. Now connect the Programmer kit to the PC (CPU) through serial cable.
3. Power up the programmer kit from the ac supply through adapter.
4. Now place the microcontroller in the GIF socket provided in the programmer kit.
5. Click on the Proload icon in the PC. A window appears providing the information like Hardware model, com port, device type, Flash size etc. Click on browse option to select the hex file to be dumped into the microcontroller and then click on "Auto program" to program the microcontroller with that particular hex file.
6. The status of the microcontroller can be seen in the small status window in the bottom of the page.
7. After this process is completed, remove the microcontroller from the programmer kit and place it in your system board. Now the system board behaves according to the program written in the microcontroller.

## IV. ADVANTAGES:

- Saves time and works for prolonged period
- Monitors all hazards and threats
- Increases production to multiple ways
- Reduces labor cost and is easy for its operation
- No need to charge the robot by external source
- Semi professional operators can perform with the robot
- It was made of durable and cheap material affordable for the small-scale peasant farmers.
- Lesser maintenance cost.
- Does not require any external Source of energy.
- Avoid the farmer being exposed to toxic pesticide vapour produced during spraying.
- The former need not spry in the hot sun, he can operate the device while standing in a cooler place.
- Improvement in planting efficiency. Increase in crop yield and cropping reliability.

**4.1 Applications**

- Hospitality,
- Can change the operation as per required in alert fields and combat
- Agricultural applications

**4.2 Limitation**

- Controlling motors are difficult
- Large dc batteries required
- Complex connections
- Suitable for small Farms Only.

- Difficult to operate in moist condition.
- Seed Sowing for Cotton is Difficult.
- Experimental Result
- Speed of plantation machine depending upon moisture
- The speed of advanced seed plantation machine depends on certain moisture level of soil. as shown in fig we have taken various result to the advanced seed plantation machine .the standard level of moisture fix those seeds in shown in red column .it shown characteristics with good performance as explained below.

## V. CONCLUSION

An RF based farmer friendly agricultural robot is thus built which can perform path formation i.e ploughing , seed dispensing and spraying water in a very less time thus increasing the efficiency of farming. Also the hard labour involved is minimized. The design is very simple and easy to operate and unique compared to the conventional method of farming. Most new machines brought to the market are bigger than the previous model. When discussing this issue with equipment manufacturers, this trend is likely to continue into the future. The driving force for this growth would seem to be to take advantage of the economies of scale that larger machines bring with them. This is easily demonstrated if the cost of the operator is taken into account. With the help of automation it is possible to perform all the operations in a farm with higher efficiency, reliability with lower risks and cost. The design of this robot at the fundamental level can be used to make various other models which will be useful and economically viable for the small and medium sized farms.

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