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Automated Pesticide Sprayer

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ABSTRACT:

Our project is a robot that can be controlled remotely to do several jobs in fields and lawns. It uses solar power to run and is partially automated, meaning a person controls it but it can also work on its own. The robot can move in four directions and has two main tools: a sprayer and a mower.The sprayer is designed to be very precise. It can spray pesticides directly onto weeds or problem areas on plants, instead of wasting chemicals by spraying everywhere. This is better for the environment and saves money. The mower can be turned on and off remotely to cut down unwanted plants. It can also be used to trim lawns and sports fields to keep them neat. The robot can even be used to just water the grass and mow it to a certain height. This robot can move at a speed of 1.4 meters per second. When it's not moving, the sprayer can cover an area of almost 1 square meter and the mower can cut an area of 0.3 square meters. The robot can also store power in a battery, which can last up to 7.2 hours when the robot isn't working very hard.

Keywords— Automatic Irrigation, Arduino UNO, Soil moisture sensor, Relay module, Automation.

Introduction :

India relies on farming, with many people in rural areas making their living from it. However, farming is still mostly done by hand or with some machines, requiring a lot of workers. Lately, it's been getting harder to find enough workers, and they're charging more too. Farmers need to be more productive to keep up.This is where our robot comes in! It can help farmers by doing some of the work automatically.

A. Automation in agriculture:

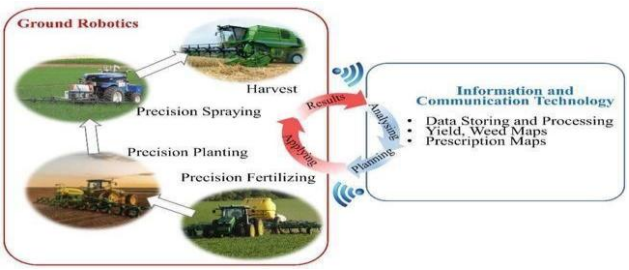


Fig 1.1: Automation in agriculture

Usually, robots in businesses are meant to replace people by doing jobs faster, better, and cheaper. Some people worry this will take away blue-collar jobs. While that might be true in some cases, our project is different. It actually helps a lot of people in different ways.

B. Pesticide spraying:

Farming in India relies on manual labor, but finding workers is getting harder and more expensive. Our solar-powered robot helps by doing several field jobs automatically. It can spray pesticides directly onto weeds, saving money and protecting the environment. It can also mow unwanted plants and maintain lawns. This helps farmers be more productive. Right now, pesticides are sprayed all over the field, not just on weeds. This wastes chemicals and can be harmful to people who use them. Even though farmers wear protective gear, they can still be exposed to dangerous pesticides and get sick.

Fig 1.2: Manual pesticide sprayer

C. Significance of solar energy:

The sun is a giant ball of gas that produces a massive amount of energy, called solar energy. In just one day, the sun creates more energy than the entire world uses in a year! This energy comes from the sun's core, where hydrogen atoms fuse together in a process called nuclear fusion. It only takes about eight minutes for this energy to travel the 93 million miles to Earth, moving at an incredibly fast speed – the speed of light! That's about 186,000 miles per second, or for science fans, 3.0 x 10^8 meters per second.

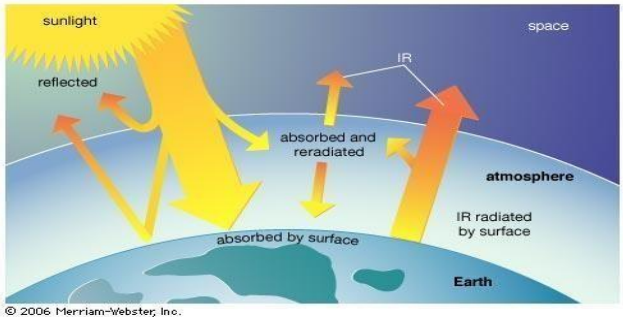


Fig1.3: Solar energy incident on earth.

We can use the sun's energy, called solar energy, to heat houses and water, and even to generate electricity! However, right now, only a tiny amount (less than 1%) of the energy the U.S. uses comes from the sun. Homes and power plants are the two main places that use solar energy so far.

D. Mower :

Those regular grass cutters used by gardeners and farmers can be tough on people. Using them by hand requires a lot of effort and can pollute the air. On top of that, the noise and vibration from these cutters are no joke! They can lead to problems with your hands and wrists, like weaker grip, numbness, tingling, and even carpal tunnel syndrome.Considering these issues (manual labor, pesticide waste, and health risks), we designed our robot to combine 3 functions into one machine. This will help farmers get more work done (increase productivity) and spend less time waiting around (reduce idle time).

Fig1.4: Manual Mowing

E. Pesticide spraying:

There are many robots being developed for all sorts of jobs these days, including farming. Some robots can even navigate farms, find weeds, and spray pesticides on them. These robots can help farmers grow more food and work more efficiently. Our project focuses on building a robot that can automatically spray pesticide on chili plants in a fertigation system (where nutrients are delivered with water). The robot has a special arm that can spray underneath the leaves, where pests like to hide. This way, less pesticide is wasted, and the farmers are protected from harmful chemicals. Overall, this robot aims to make pesticide use in chili farms safer and more effective.

F.Solar cell:

A solar cell, also called a photovoltaic cell, is a device that turns sunlight into electricity. It's like a small machine with a large surface area. Photovoltaic (say: foe-to-vol-ta-ic) is the whole field of science and technology behind using these cells to capture the sun's energy. Solar cells are the building blocks for bigger things like solar panels and arrays. These panels are what you might see on rooftops that convert sunlight into the electricity we use in our homes!

First generation: The first generation of solar cells are like the original ones - big, good quality, and built with just one layer (junction). Making these first-generation cells takes a lot of effort and energy, which keeps them expensive. Even though they're expensive, these single-layer silicon cells are getting close to their best possible efficiency (around 33%). In some places, they can even compete with fossil fuels (like coal or oil) for generating electricity after a few years (5-7) of use.

Second generation: Scientists created new materials (second generation) to make solar cells cheaper and more efficient. They also came up with different ways to build them (like vapor deposition and electroplating) that don't require extremely high temperatures.
In the long run, the cost of these cells will likely depend on the materials used, like the silicon base or glass cover.
While these new methods can make solar cells cheaper (almost affordable), they also make them less efficient at turning sunlight into electricity compared to the first generation. There's a trade-off between price and performance.

G. Mower:

India is a major producer of food, ranking second in the world for wheat and rice. They're also in the top five for many other crops, like coffee and cotton. India's farms also raise a lot of livestock and poultry, and this industry is growing quickly. However, harvesting crops in India is still done in traditional ways, which requires a lot of effort and money. Lawnmowers make it easier to care for lawns, which are becoming more common as businesses try to be more eco-friendly. But with more green spaces, there's also more work to maintain them. This basically says that India is a big player in agriculture, but there's a need for new methods (like our robot!) to make farming easier and more efficient.

Our approach:

Our project is a solar-powered robot designed to help farmers with two important tasks: spraying pesticides and removing weeds (or even cutting crops). This isn't the first robot to work on farms - many robots already assist with harvesting, planting, and weed control. Typically, these robots use four key features: navigation (finding their way around), detection (seeing what's near them), mapping (knowing the farm layout), and action (doing their job). Our robot stands out because it uses solar power, making it environmentally friendly and cost-effective. It also helps farmers save on labor and pesticide use, and keeps everyone safe with a precise spraying system.

OBJECTIVES:

Our robot is designed to make farmers' lives easier in a few key ways. First, it will reduce the manual labor required for many farm tasks. This frees up farmers' time and energy for other important jobs. Second, the robot can perform multiple tasks at once, like spraying pesticides and removing weeds. This multitasking ability helps farmers be more productive and get more done in less time. Finally, the robot operates on command, meaning farmers have complete control over what tasks it performs.

COMPONENTS:

HARDWARE COMPONENTS REQUIRED:

3.1 Components in detail

Arduino Uno:

The Arduino is the best board to get started and coding. When working with a UNO chip, don't be afraid to experiment! If you make a mistake, it's no big deal. For just a few dollars, you can replace the chip and start fresh.

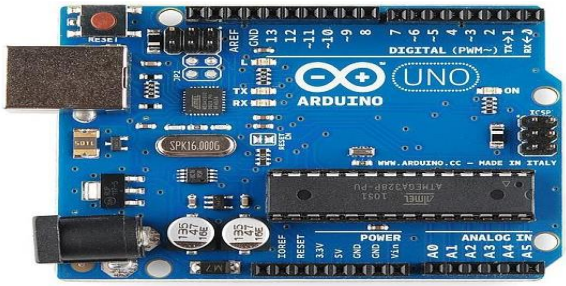


Fig 3.1 Arduino UNO

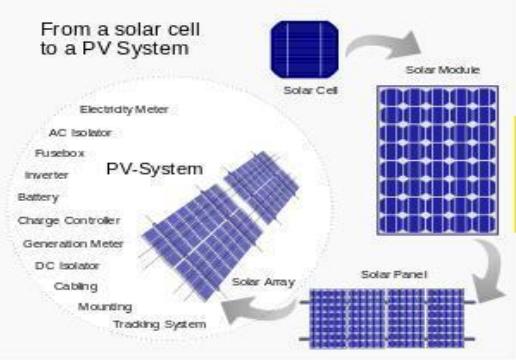
Solar panel:

A solar panel, also called a photovoltaic (PV) module, is basically a collection of many smaller solar cells put together in a frame. These cells use sunlight as their fuel to generate electricity, but the kind of electricity they make is a direct current (DC). If you need regular electricity (AC) to power your appliances, you'll need additional equipment. Multiple solar panels can be hooked together to form a larger solar array. These arrays are what you typically see on rooftops, and they provide the power for solar electricity systems.

Theory and constitution:

Most solar panels are stiff and like a framed picture. But there's also a newer kind that's more flexible, kind of like a thin sheet. These panels are made up of many tiny solar cells. The cells are wired together in a special way: like daisy-chaining a necklace to get the right voltage (strength of the electricity) and then side-by-side to get more amperage (amount of electricity flowing). The wattage, which is how much power the panel makes, is simply the voltage times the amperage. It's important to remember that the numbers you see on.

Fig 3.2. Construction of solar panel



Solar panel efficiency:

The strength of a solar panel's electricity (DC output power) is measured under ideal conditions (sunshine, temperature) and labeled in watts (W). Typical panels range from 100 to 365 watts. Efficiency refers to how much sunlight a panel can actually turn into electricity. A more efficient panel will be smaller and produce the same amount of power as a less efficient, larger one (think of it like using less gas to drive the same distance). The best commercially available solar panels can be around 24% efficient, but this is usually a bit lower than the efficiency of the individual solar cells themselves. It's important to remember that the numbers you see on a solar panel are for perfect conditions, not what you'll always get in real life.

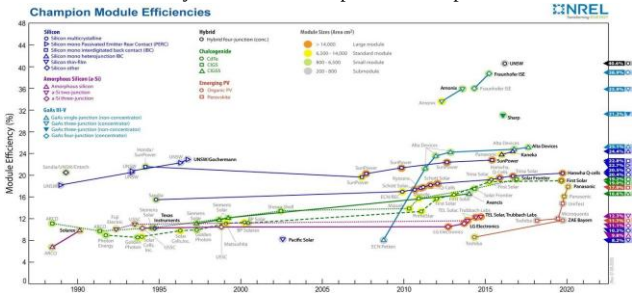


Fig 3.3. Module efficiencies of a solar panel

Technological significance:

Most solar panels today are made from silicon, just like computer chips! There are two main types: crystalline silicon, which is the most common and comes in cheaper multi-crystalline or more efficient monocrystalline varieties. Then there are thin-film panels, a newer and generally less expensive option that uses different materials than silicon. They're not quite as powerful as crystalline silicon panels, but they come in types like cadmium telluride or copper indium gallium selenide. Finally, there are even more advanced solar cell technologies in the works, like super-efficient multi-junction cells used in space, or concentrator photovoltaics that use lenses to focus sunlight. These last ones are too expensive or complex for everyday use yet, but they show promise for the future!

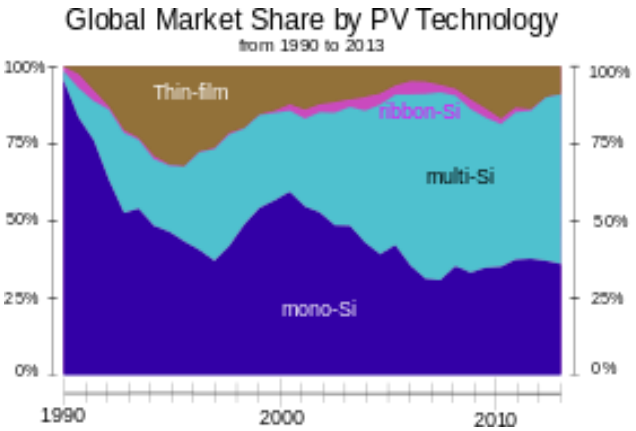


Fig 3.4. Global market share for solar panels

DC Motors:

A DC motor is a type of engine that uses electricity directly from batteries or a power supply to spin. It's different from the motors that power most appliances at home, which use alternating current (AC). These DC motors are common because they're good at starting and stopping quickly, and their speed can be easily controlled. You can find them in many things, from tiny toys to power tools.

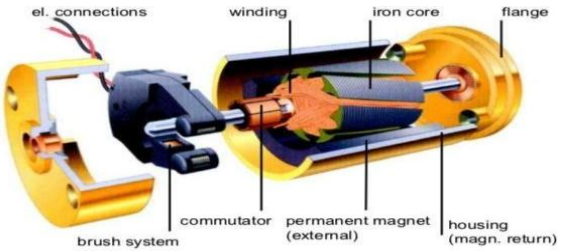


Fig 3.5. DC motor

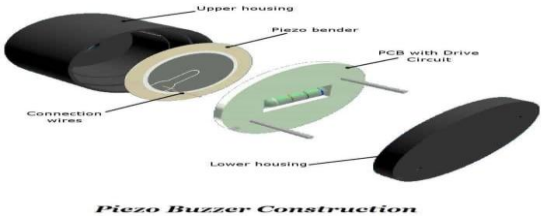
PIR Sensor:

A passive infrared (PIR) sensor is like a special detector that can sense heat. It doesn't give off any heat itself, but it can pick up infrared light (heat waves) radiating from objects in front of it. These PIR sensors are often used in motion detectors for security alarms and automatic lights. So, if you walk by a sensor with these lights, they might turn on because your body heat triggers the sensor.

Fig 3.6. PIR Sensor

Piezo Buzzer*:*

A piezo buzzer is a small and cheap electronic device that can make sounds or alarms. It's kind of like a tiny speaker, but simpler and less expensive. Even though it's basic, piezo buzzers can be very reliable and come in different sizes to create all sorts of sounds!



Piezo Buzzer Construction

Fig 3.7. Piezo Buzzer

Gas Sensor:

Imagine a tiny nose for your house or car! Gas sensors are like that - little devices that can detect how much gas is in the air. They don't just tell you there's gas, they can also figure out what kind of gas it is and how much there is of it. They do this by sending out electrical signals, kind of like talking in a special code. This helps us understand the quality of the air around us and avoid any dangers from gas leaks.

Fig 3.8. Gas Sensor

WORKING :

Get your robot ready for action! First, make sure the program is uploaded to the Arduino board following the instructions in the previous chapter, and double-check all the connections. Download the RC Bluetooth app from your phone's app store. Then, power on the robot by connecting the battery. You'll see lights indicating everything is working. Now, open the RC Bluetooth car app and connect to the robot's Bluetooth module (HC-05) in the settings. Finally, you can optionally adjust the robot's vertical and horizontal movements, as well as the spraying nozzle, to suit your field before taking control with the app. Imagine a robot farmer! That's basically what an automated pesticide sprayer is. It uses a combination of wheels, GPS, and even lasers to move around a field by itself, spraying crops with pesticides. The robot brain, its control system, uses software to make sure the spraying is precise. This means less pesticide is wasted and less ends up in places it shouldn't. Farmers control the robot's path and monitor its work remotely using a phone app or remote control. Overall, these robotic sprayers can help farmers work faster, waste less pesticide, and avoid exposure to harmful chemicals. It's like a helping hand (or rather, claw) for modern agriculture!

FUTURE SCOPE :

Farming is getting a high-tech upgrade! Mechatronics, which combines mechanics, electronics, and software, is being used to create new autonomous robots for farms. These robots can handle many different tasks, like harvesting crops, spraying fertilizer, and even planting seeds. They use sensors and computer programs to do their jobs precisely and efficiently, which is better than traditional farm equipment in a few ways. For example, robots can work in tough conditions, avoid compacting the soil (which can hurt plant growth), and use less fertilizer. This technology is still under development, but researchers are excited about the potential for these robots to make farming easier, more productive, and more reliable.

CONCLUSION :

Our testing showed the robot covered a good amount of ground at a reasonable cost. This is especially helpful because it can address the lack of farm workers and keep farmers safe. The robot can be controlled remotely, so farmers don't have to directly handle harmful chemicals or spend long hours cutting crops or weeding. It's also versatile! This robot isn't just for farms - it can be adjusted to different sizes and used for spraying fertilizers, pesticides, watering lawns, mowing, and even maintaining sports fields.

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REFERENCES :

1.Adamides, G.; Katsanos, C.; Parmet, Y.; Christou, G.; Xenos, M.; Hadzilacos, T.; Edan, Y. **2017**, 62, 237–246. [CrossRef] [PubMed].

2.Balloni, S.; Caruso, L.; Cerruto, E.; Emma, G.; Schillaci, G. Innovation Technology to Empower Safety, Health and Welfare in Agriculture and Agro-food Systems, Ragusa, Italy, 15–17 September 2008.

3.Bonaccorso, F.; Muscato, G.; Baglio, S. Laser range data scan-matching algorithm for mobile robot indoor self-localization. In Proceedings of the World Automation Congress (WAC), Puerto Vallarta, Mexico, 24–28 June 2012; pp. 1–5.

4.Berenstein, R.; Shahar, O.B.; Shapiro, A.; Edan, Y. Grape clusters and foliage detection algorithms for autonomous selective vineyard sprayer. Intell. Serv. Robot. **2010**, 3, 233–243. [CrossRef].

5.Bergerman, M.; Singh, S.; Hamner, B. Results with autonomous vehicles operating in specialty crops. (ICRA), St. Paul, MN, USA, 14–18 May 2012; pp. 1829– 1835.