IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 3, March 2024

DOI: 10.17148/IJARCCE.2024.13345

Development and Manufacture of Solar Power Seed Sprayer Machine

Prof. R. B. Khule[1], Kundan Gahukar[2], Bhawar Ninawe[3], Sourabh Balbudhe[4]

Assistant Professor, Department of Electronics & Telecommunication Engineering KDK college of Engineering, Nandanvan Nagpur-440009, Maharashtra, India[1]

Student, Department of Electronics & Telecommunication Engineering KDK college of Engineering, Nandanvan Nagpur-440009, Maharashtra, India[2-4]

Abstract: In today's era of rapid growth across all sectors, including agriculture, meeting future food demands necessitates the adoption of new techniques. To address this need, this project focuses on the "Design and Fabrication of a Solar Seed Sprayer Machine." This innovative approach involves spraying seeds from a hopper onto the land using a fan or blower, eliminating the need for human effort during seeding. By streamlining the process, seeds are efficiently sown during ploughing, reducing both time and labor. Notably, this machine operates solely on solar power, eliminating the need for additional energy sources. Overall, this system offers a sustainable and efficient solution to enhance crop production while preserving soil texture and minimizing human involvement. A seed sprayer machine is a piece of agricultural equipment used for sowing seeds onto fields. It operates by dispersing seeds evenly across the soil surface, ensuring optimal seed-to-soil contact for germination and crop growth. These machines come in various sizes and configurations, ranging from handheld seed spreaders for small-scale farming to large tractor-mounted seed drills for commercial agriculture. Seed sprayer machines typically consist of a seed hopper, which holds the seeds, and mechanisms for seed distribution, such as pneumatic systems, augers, or seed plates. Some modern seed sprayer machines may also incorporate precision technologies, such as GPS guidance systems and variable rate seeding, to optimize seed placement and maximize crop yield.

Keywords: Seed Sprayer Machine, Relay, Bluetooth Module, Robot, Solar Panel, DC Motors.

I. INTRODUCTION

Over the decades spanning from 1970 to 2024, Indian agriculture witnessed transformative phases including the Green Revolution, policy reforms, technology adoption, a shift towards sustainable practices, digitalization, and facing challenges like land fragmentation, water scarcity, and market inefficiencies, further exacerbated by the COVID-19 pandemic, highlighting the need for sustainable and inclusive agricultural development to ensure food security, rural livelihoods, and environmental sustainability.

India, predominantly an agrarian nation with 70% of its population dependent on farming, faces economic challenges as farm sizes shrink due to population growth, resulting in farmers typically owning small plots of land. Limited resources hinder investment in modern machinery, forcing reliance on labor-intensive traditional methods, perpetuating poverty cycles. Factors like inadequate credit, poor infrastructure, and volatile markets exacerbate farmer hardships. Addressing these barriers through affordable financing, modern training, and market access is vital for sustainable agricultural development. Many farmers also utilize animals like bullocks and buffalo for farming, enhancing efficiency and global competitiveness while reducing dependency on unpredictable human labor. Our smart multifunction agribiont aims to alleviate these challenges and labor issues.

In this paper, Manufacturing a solar-powered seed sprayer machine involves integrating solar panels to power the machine, fabricating components like the seed hopper and distribution mechanisms, assembling the machine, testing for quality and performance, and packaging for distribution, ensuring sustainable and efficient seeding operations.

II. RELATED WORK

Author R. Suganya1, U. Jayaranjani2 developed an “Design of Solar Powered Automatic Pesticide Sprayer, Grass Cutter and Seed Sower using WIFI”. This paper [1] is introduced an advanced seed sprayer machine which includes solar system and Bluetooth. But the system is more complex and not advanced as per the today's development.

DOI: 10.17148/IJARCCE.2024.13345

In this paper[2] design and fabrication of solar seed sprayer machine introduced by 1T.Ravi, 2D.GobiGanesh, 3R.Gokulakannan, 4M.Kandeeswaran, 5V.Kesavan. This authors gives the basic constructional detail about seed spray hardware structure. The overall system is driven by the fuel only. The fuel-based system is one of the big disadvantages of this paper.

In the "Solar Powered Seeds Sprayer Machine Control by Mobile". This paper [3] Pawar Shekhar Gangadhar1, Rutuja Ravindra Gorane2, Shivani Shivaji Labhade3 Punam Shivaji Labhade4, Aarti sandip Jadhav5 authors are introduced the system on seed sprayer machine for the harsh environment but the complexity of system and cost is also high.

Authors Ammar A.M. Al- Talib1, Yap Chee Xian2, Ain Atiqa3, Nor Fazilah Abdullah4, introduced an Solar Powered Seed Sprayer Machine. In this paper [4] authors give some basic idea about seed spray machine. But this older version system and not comfortable with different enviroments and technology vise as well.

III. METHODOLOGY

The development and manufacture of the solar-powered seed sprayer machine involve integrating solar panels for energy generation, designing components such as the seed hopper and distribution system, assembling the machine, and incorporating technological features like Bluetooth control for tire rotation and Arduino-relay systems for sprayer activation, ensuring efficient and sustainable seed sowing operations.

The design of manufacturing seed spray machine is more important for this paper. So the design of system architecture is very important as for the proper development in seed system. This design ensures proper balanced of system during the design periods. Below shows the Fig 3.1 Architecture of Seed sprayer machine.

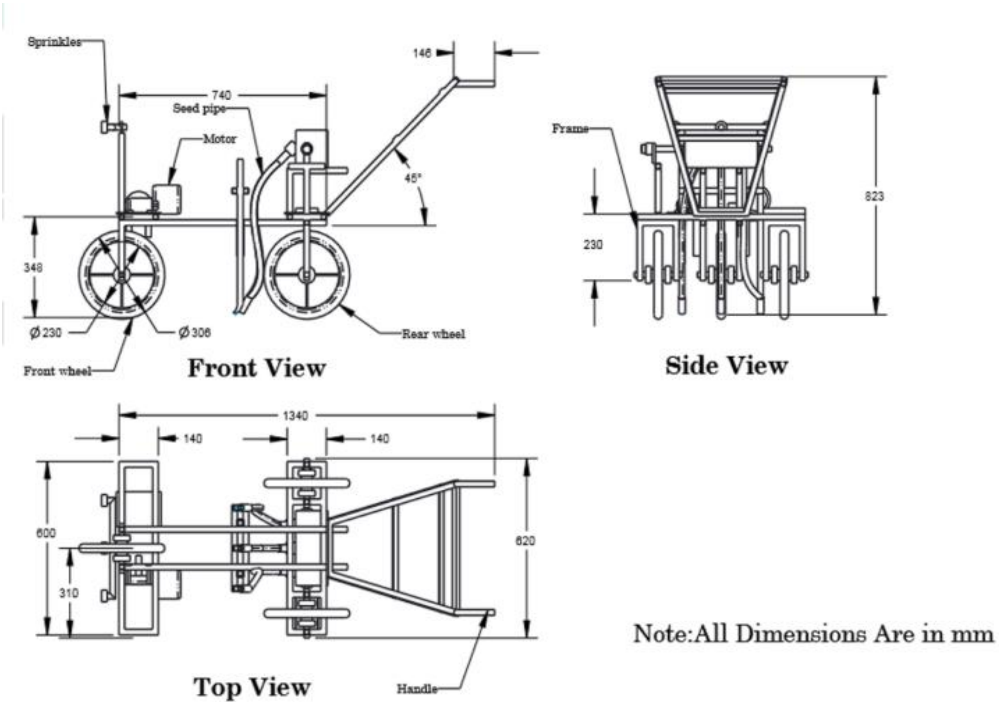

Fig 3.1 Architecture of Seed sprayer machine.

3.1 COMPONETS

- LCD DISPLAY
- Arduino Uno
- Motor Driver
- DC Motor
- Relay
- Solar Panel

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 3, March 2024

DOI: 10.17148/IJARCCE.2024.13345

- Seed Roller
- Bluetooth module
- DC Water Pump

3.1.1 LCD DISPLAY

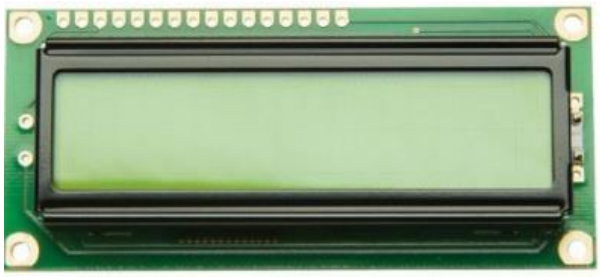

Fig 3.1.1 LCD Display

An LCD (Liquid Crystal Display) is a flat panel display technology that uses liquid crystals sandwiched between two transparent electrodes to produce images or text. When an electric current passes through the liquid crystals, they align to control the amount of light passing through, thus forming the display.

3.1.2 Arduino Uno

Fig 3.1.2 Arduino uno

Arduino Uno is a popular microcontroller board based on the ATmega328P microcontroller, featuring digital and analog input/output pins, USB connectivity for programming and power, and a user-friendly interface for developing and prototyping various electronic projects and applications.

3.1.3 Motor Driver

The L293D is a popular integrated circuit (IC) used as a motor driver, capable of driving up to two DC motors bidirectionally.

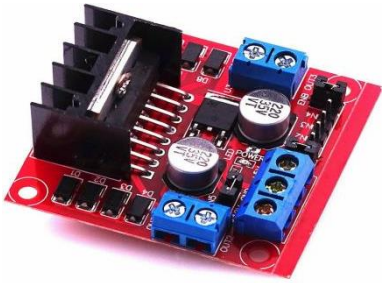

Fig 3.1.3 Motor Driver

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 3, March 2024

DOI: 10.17148/IJARCCE.2024.13345

It provides separate inputs for controlling the direction and speed of each motor, along with built-in protection diodes to prevent damage from back electromotive force (EMF). It's commonly used in robotics and other projects requiring motor control.

3.1.4 DC Motor

Fig 3.1.4 DC Motor

A DC (Direct Current) motor is an electrical machine that converts electrical energy into mechanical energy. It operates on the principle of electromagnetic induction, where a current-carrying conductor placed in a magnetic field experiences a force, causing it to rotate. DC motors consist of a stator (stationary part) and a rotor (rotating part), typically with a commutator and brushes to maintain the direction of current flow in the rotor windings. They are commonly used in a wide range of applications, including appliances, robotics, vehicles, and industrial machinery, due to their simplicity, reliability, and controllability.

3.1.5 Relay Module

Fig 3.1.5 Relay Module

A relay module is an electronic device that includes one or more relays mounted on a circuit board, along with necessary supporting components like drivers, diodes, and connectors. Relays are electromechanical switches that can control high-power circuits using low-power signals. The relay module allows you to easily interface relays with microcontrollers, Arduino boards, or other electronic systems. It typically provides screw terminals or headers for connecting external circuits, making it convenient for applications such as home automation, industrial control, and robotics.

3.1.6 Solar Panel

Fig 3.1.6 Solar Panel

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 3, March 2024

DOI: 10.17148/IJARCCE.2024.13345

A solar panel, also known as a photovoltaic (PV) panel, is a device that converts sunlight into electricity using the photovoltaic effect. It consists of multiple solar cells made of semiconductor materials like silicon. When sunlight strikes these cells, it excites electrons, creating an electric current. The solar cells are interconnected and encapsulated within a protective frame to form a solar panel. Solar panels are commonly used to generate renewable electricity for various applications, including residential and commercial buildings, remote power systems, and spacecraft. They offer a sustainable and environmentally friendly way to harness solar energy for power generation.

3.1.7 Seed Roller

A seed roller, also known as a seed drill or seed planter, is a piece of agricultural equipment used for planting seeds in rows at a consistent depth and spacing. It typically consists of a hopper for holding seeds, a mechanism for metering out the seeds at a controlled rate, and a system for placing the seeds into the soil.

Fig 3.1.7 Seed Roller

The seed roller is typically attached to a tractor or other agricultural machinery and is dragged across the field while the seeds are planted. It ensures that the seeds are planted at the correct depth and spacing, which is essential for optimal germination and crop growth. Seed rollers are used in various types of farming, including row cropping, where crops are planted in evenly spaced rows. They help farmers to efficiently plant large areas of land while ensuring uniformity and precision in seed placement.

3.1.8 Bluetooth module

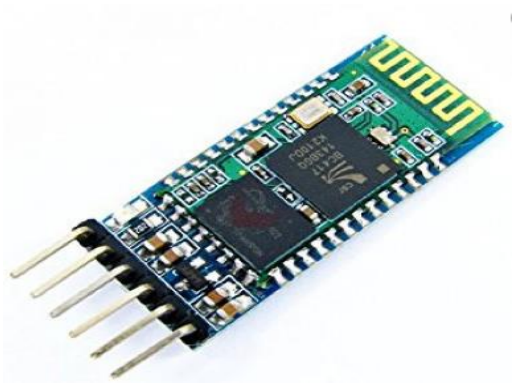

Fig 3.1.8 HC-05 Bluetooth module

The HC-05 is a commonly used Bluetooth module that enables wireless communication between electronic devices. It operates on the Bluetooth 2.0 standard and supports Serial Port Protocol (SPP) for serial communication. The module can be easily interfaced with microcontrollers like Arduino and Raspberry Pi, allowing for wireless control and data transmission over short distances. With its simple AT command set, the HC-05 is user-friendly and versatile, making it suitable for a wide range of applications such as home automation, robotics, and wireless sensor networks.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 3, March 2024

DOI: 10.17148/IJARCCE.2024.13345

3.1.9 DC Water Pump

Fig 3.1.9 DC Water Pump

A DC water pump is a type of pump that operates using direct current (DC) electrical power. It is commonly used for pumping water from wells, tanks, or other water sources in off-grid or remote locations where AC (alternating current) power may not be readily available.

DC water pumps are often used in solar-powered water pumping systems, where they are powered by photovoltaic panels or batteries. They come in various sizes and designs to accommodate different flow rates and water pumping requirements. These pumps are efficient, reliable, and suitable for a wide range of applications, including irrigation, livestock watering, household water supply, and water circulation in ponds or fountains. They offer flexibility and versatility in water pumping operations, particularly in areas with limited access to electricity grid infrastructure.

3.2 BLOCK DIAGRAM

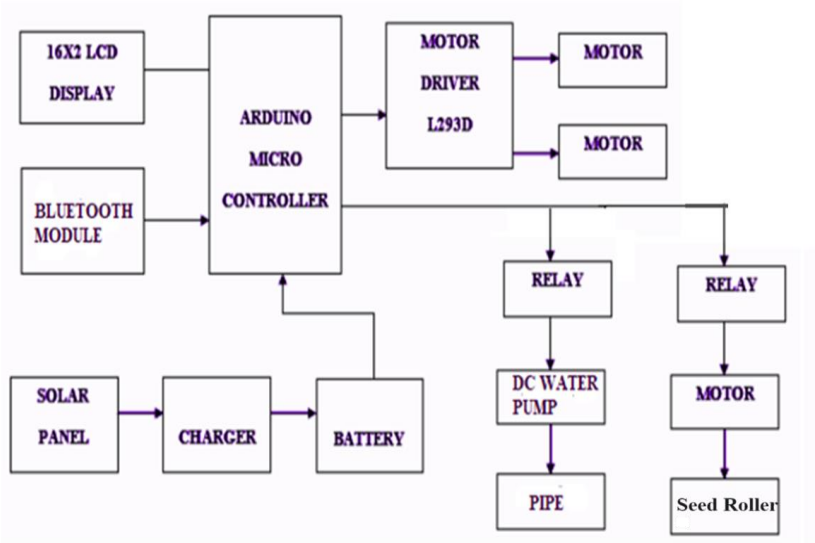

Fig 3.2 solar power-based seed sprayer machine

The diagram you sent is actually for an automatic solar based seed sprayer machine. However, the underlying principles for the solar power system would be similar. The brief explanation and role of each component are mentioned below.

Solar Panel: This converts sunlight into electricity to power the machine.
Solar Charger: This regulates the electricity from the solar panel and charges the battery.
Battery: This stores the electricity generated by the solar panel to power the machine when the sun is not shining.
Arduino Micro Controller: This is a programmable circuit board that controls the operation of the machine.
Motor Driver: This component controls the direction and speed of the motor.
Motor: This drives the machine's wheels.
Bluetooth Module: This allows for wireless communication between the machine and a smartphone or other device.
Relay: This is an electronic switch that turns on or off the motors based on signals from the Arduino micro controller.
LCD Display: This shows information about the machine's operation.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 3, March 2024
DOI: 10.17148/IJARCCE.2024.13345

In a solar seed sprayer, the motor would likely be connected to a pump that would draw water from a tank and spray it through nozzles. The Arduino controller could be programmed to control the flow rate of the seeds and the spray pattern.

I couldn't find a diagram for a solar powered seed sprayer machine, but the concept is similar. The solar panel would collect sunlight and convert it into electricity. This electricity would then be used to power a motor that would drive a pump. The pump would draw water from a tank and spray it through nozzles, along with seeds.

IV. ADVANTAGES & DISADVANTGES

Advantages:

1. Environmentally Friendly: Solar power is a clean and renewable energy source, reducing greenhouse gas emissions and dependence on fossil fuels.

2. Cost Savings: Once installed, solar power is essentially free, reducing operational costs compared to traditional fuel-powered machines.

3. Versatility: Solar power allows the seed sprayer to be used in remote areas without access to electricity grids, expanding agricultural capabilities.

4. Quiet Operation: Solar-powered machines typically operate quietly, reducing noise pollution compared to fuel-powered alternatives.

5. Long-Term Investment: With proper maintenance, solar panels can have a long lifespan, providing a consistent power source for the seed sprayer over many years.

Disadvantages:

1. Initial Cost: The upfront cost of purchasing and installing solar panels and associated equipment can be higher compared to traditional fuel-powered machines.

2. Weather Dependence: Solar power generation is dependent on weather conditions, such as sunlight availability. Cloudy days or extended periods of inclement weather can reduce the efficiency of the seed sprayer.

3. Limited Power Output: Solar power systems have a limited power output, which may not be sufficient for high-demand agricultural operations or during peak usage times.

V. APPLICATIONS

Remote Farming Areas: In remote areas where access to electricity grids is limited or non-existent, solar-powered seed sprayer machines can provide an efficient solution for farmers to sow seeds without relying on traditional fuel-powered equipment.

Off-Grid Farming: Even in areas with access to electricity, certain fields or plots may be located far from power sources. Solar-powered seed sprayers offer a practical solution for off-grid farming, eliminating the need for long power cables or fuel transportation.

Small-Scale Farming: Small-scale farmers or community gardens may benefit from solar-powered seed sprayer machines, as they offer a cost-effective and environmentally friendly alternative to larger, fuel-powered equipment. These machines can help increase productivity and yield without significant financial investment.

Precision Agriculture: Solar-powered seed sprayers can be integrated into precision agriculture systems, allowing farmers to precisely control the distribution of seeds based on soil conditions, crop types, and other variables. This enhances efficiency and reduces waste.

Organic Farming: For organic farming practices where minimizing environmental impact is crucial, solar-powered seed sprayers align well with sustainability goals. They produce no emissions during operation and can contribute to an eco-friendlier farming approach.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 3, March 2024
DOI: 10.17148/IJARCCE.2024.13345

Research and Development: Solar-powered seed sprayers can be used in agricultural research and development projects to test new seed varieties, planting techniques, or crop management strategies. Their versatility and mobility make them suitable for experimental field trials.

Disaster Relief and Humanitarian Aid: In regions affected by natural disasters or humanitarian crises, solar-powered seed sprayers can assist in rapidly restoring agricultural activities. They provide a sustainable solution for distributing seeds and revitalizing damaged farmland.

Greenhouse Farming: Solar-powered seed sprayer machines can be adapted for use in greenhouse environments, where precise seed distribution is essential for optimal plant growth. They offer a renewable and cost-effective alternative to traditional greenhouse equipment powered by fossil fuels.

VI. CONCLUSION

The integration of Bluetooth technology into solar-based seed sprayer machines offers several significant benefits for agricultural operations. By leveraging Bluetooth connectivity, these machines can enable seamless communication and control between the sprayer and external devices such as smartphones or tablets. This allows for remote monitoring and management of seeding activities, enhancing efficiency and convenience for farmers. Moreover, Bluetooth technology facilitates data exchange and analysis, enabling farmers to gather insights into seeding operations and optimize performance over time. Real-time data on seed distribution, field conditions, and equipment status can be transmitted wirelessly, empowering farmers to make informed decisions and improve productivity.

REFERENCES

[1]. Ammar A.M. AI- Talib, Yap Chee Xiam, Aim Atiqa, Nor Fazilah Abdullah, UCSI University, 56000 Kuala Lampur, Malaysia, 9 Feb 2023By systematically comparing the effects of different seeding techniques, machinery, and application rates, valuable insights were gained regarding their respective contributions to overall crop performance. This research provides valuable guidance for farmers and agricultural practitioners seeking to optimize oilseed rape cultivation practices to achieve higher yields and improve overall efficiency.

[2]. Jeonghyeon Pak, Jeongeun Kim, Yonghyun Park, Hyoung IL Son (Senior Member, IEEE) 7 May 2022. The research findings strongly suggest that bullock-drawn planters are increasingly indispensable for sowing operations, particularly due to the scarcity of skilled workers proficient in traditional sowing methods. With a dwindling pool of skilled laborers, mechanized solutions like bullock-drawn planters offer a viable alternative, ensuring efficient and timely sowing without relying heavily on manual labor.

[3]. Prof. Yayati shinde, Shantanu chandane, akash mandave, shweta nehete, Prerna vishe, international research journal may-2021. The seed sowing machine stands out as a cornerstone of modern agriculture, revolutionizing the way crops are planted. Among the advancements in this domain, high precision pneumatic planters have emerged as game-changers, catering to a diverse array of crops and seed sizes with unparalleled accuracy.

[4] Ghalib Ahmed Tahir, Chu Kiong Loo (Senior member, IEEE) 20 March 2020. Another agricultural researcher undertook a comprehensive investigation to evaluate the impacts of various seeding techniques, machinery, and different rates of oilseed rape application on seeding emergence, plant establishment, and final grain yield. This study aimed to provide valuable insights into optimizing oilseed rape cultivation practices for enhanced productivity.

[5] Offer GJ, Howey D, Contestabile M, Clague R, and Brandon NP 2010 J. Energ.Poli.38 24.

[6] Saeid B, Scott J. Moura, Joel C. Forman, Hosam K. Fathy 2010 J. Power Sources 196 8.

[7] Andrew Burke, Marshall Miller 2010 J. Power Sources, 196 514.

[8] MatthieuDubarrya, Cyril Truchota, Bor Yann Liawa,, Kevin Geringb, SergiySazhinb, David Jamisonb,ChristopherMichelbacherb 2011, J. Power Sources,196 10336.

[9] Jenn-Jiang Hwang, Yu-Jie Chen, Jenn-Kun Kuo 2012, Int. J. of hydrogen energy, 37 4476.

[10] Kermani.S,Delprat.S, Guerra, Trigui.R 2012, Jeanneret Control Engineering Practice, 20 408.

[11] Bor Yann Liaw,MatthieuDubarry 2007 J. Power Sources, 174 76.

[12] GeorgiosFontaras, PanayotisPistikopoulos, Zissis Samaras 2008 Atmospheric Environment 424023