

Islamic Da'wah Through Technology in Modern Agriculture Using A Powered Seed Sowing Robot

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Abstract

Farming feeds the world. However, the industry struggles with a dwindling workforce and rising production costs. Traditional methods fail to meet the needs of a growing global population. This research introduces a solar-powered robot designed for the Brunei context - a machine that uses renewable energy to automate seed sowing while adhering to Islamic ethical standards. The results look promising. We used the ADDIE model to guide our mixed-method approach, gathering data through surveys and interviews. Farmers and experts showed a clear preference for these automated systems. They pointed toward efficiency and environmental care as the biggest wins. This isn't just about gears and circuits, nor is it purely about profit. The study weaves in concepts like Amanah and Khalifah to show how engineering serves as a practical form of religious outreach. By helping local growers and protecting the earth, this invention acts as a modern tool for community welfare.

Keywords: Islamic Da'wah, Agricultural Robotics, Solar Energy, Sustainable Agriculture, Seed Sowing Robot, Smart Farming, Renewable Energy

1. Introduction

Civilization rests on agriculture. It provides the food, jobs, and stability required for any society to thrive. But the current path is unsustainable due to shrinking workforces and climbing overhead. As the global population spikes, the pressure to produce more with less environmental damage becomes intense. This reality forces a shift. Researchers and governments are now looking toward high-tech systems to replace aging, inefficient farming habits.

The fourth industrial revolution changed the game. Digital tools, sensors, and autonomous machines are now common in the field. Smart farming allows growers to boost their output without wasting precious resources. Robots and self-driving tractors are no longer science fiction; they are necessities for tackling labor gaps. Solar power stands out here. It is clean, cheap over the long run, and fits perfectly with the needs of rural operations.

Brunei Darussalam needs this shift. The nation wants to secure its food supply and move away from oil-heavy economics. Most local farms are small or medium-sized operations that still lean on manual labor. Even though the sun shines year-round, renewable energy remains an untapped resource in the fields. There is also a heavy reliance on foreign workers. These gaps create a perfect opening for home-grown technological solutions.

Planting seeds is gruelling work. Doing it by hand takes forever and often leads to uneven crops that don't grow well. Big commercial machines exist, but they are expensive and burn fossil fuels. Such barriers

keep small farmers stuck in the past. We need something affordable and green. This study fills that void by building a solar-powered seeder that cuts costs while speeding up the process.

Islam offers a roadmap here. It tells believers to seek out knowledge that helps people. The Quran and the Prophet's teachings encourage us to look at nature and use resources wisely. In this view, a robot isn't just a tool; it is a trust. Innovation must benefit the community and stay within moral bounds.

Four ideas drive this ethical approach. Amanah means being responsible for the tools and nature God provided. Khalifah positions humans as guardians of the planet. Ihsan demands excellence in every design and calculation. Finally, Maslahah focuses on the public good. Together, these principles ensure that a robot does more than just dig holes - it builds a better society.

Da'wah is often seen as just talking. But the real issue is how we act. Modern outreach happens through solving problems and showing how faith applies to the real world. Building a solar robot is a practical sermon. It shows a commitment to the earth and the people who feed us. This research argues that faith and engineering are partners in progress.

The goal here is simple. We want to see if Brunei's farmers want this tech, build a working version, and then see how well it actually performs. This data helps us understand the intersection of smart farming and Muslim values. We believe that by using Amanah and Maslahah as guides, technology becomes a powerful platform for Da'wah.

2. Literature Review

2.1 Modern Agriculture and Sustainable Development

The way we grow food is changing fast. High demand and shifting climate mean old ways don't work anymore. Precision tools are taking over from back-breaking manual labor. These systems aim for a balance between high yields and low environmental footprints.

Smart farming is the new standard. It uses AI, robots, and the sun to make sure every seed counts. Unlike old-school methods, these tools let a farmer watch their crops in real-time. This isn't just a trend; it is a survival strategy for the industry.

Studies show that automation works. It makes things consistent and solves the problem of not having enough workers. As people move to cities, autonomous systems become the only way to keep the lights on in the agricultural sector. This is especially true in regions still stuck with manual processes.

Brunei's food security depends on this transition. Currently, the sector is small but vital. Most of the work is done by foreign hands, and tech adoption is low. This creates a massive chance to introduce green solutions that support national goals. Sustainable innovation is about more than just food; it is about economic grit.

2.2 Agricultural Robotics

Robots are the heavy lifters of the new age. They handle the boring, repetitive stuff like weeding, watering, and sowing. Because they don't get tired, they can work around the clock to keep costs down. Modern machines are getting smarter. They use cameras and GPS to navigate fields without hitting anything. Seed sowing robots are great because they get the depth and spacing exactly right every time. This leads to better harvests. But there are catches. High prices and the need for constant repairs keep many farmers away. You also need to know how to code or fix a circuit board to use them effectively. These hurdles are real.

Our own findings back this up. People like the idea of efficiency but worry about the price tag. Still, the general mood is positive. Most see robots as the future of Brunei's fields. The goal isn't to replace humans,

but to let them focus on the big-picture management.

2.3 Solar Energy in Smart Agriculture

Fossil fuels are on the way out. Renewable energy is the only way to keep farming sustainable. Solar is the best bet because it is everywhere and the sun doesn't send a monthly bill. You can use solar for almost anything on a farm. It powers pumps, keeps greenhouses warm, and runs robots. Compared to diesel, it is quieter and cleaner. It just makes sense.

Brunei is right on the equator. We have sun all the time. Yet, we barely use it in our fields. This is a missed opportunity. Our robot fixes this by using the sun to power its motors and brain. This aligns with global goals to cut carbon. It shows that green tech can be practical.

2.4 Islamic Perspective on Technology

Islam loves science. The Quran tells us to explore and use our brains to help others. Religion and tech aren't enemies; they have been partners for centuries. Muslim scholars were the original masters of engineering and math. Four concepts guide us:

Amanah (Responsibility)

This is about being a good manager. Using solar power is a way to respect the environment God gave us.

Khalifah (Stewardship)

We are the earth's caretakers. Tech that stops pollution is a religious duty.

Ihsan (Excellence)

If you build something, build it well. This drives us to make the best robot possible.

Maslahah (Public Benefit)

The point of a robot is to help people. If it makes food cheaper or life easier, it is a win for the community.

2.5 Da'wah Through Technology

Da'wah is about more than just words. It is about showing the beauty of faith through action. When you use science to protect the earth or help a poor farmer, you are doing Da'wah. Our robot is a moving example of this. It represents care for the environment and smart resource use. By helping the community, the project communicates Islamic values without saying a word. This broadens what it means to be a missionary in the modern world. Engineers have a huge role to play here.

2.6 Research Gap

Most people study robots or religion separately. Very few look at how they fit together. Often, commercial robots are too expensive or don't care about ethics. They just want to maximize profit. In Brunei, most research stays on the surface. It talks about problems but doesn't build local solutions. We need tools that fit our specific soil and our specific values. Our data shows people want this. They want something cheap, easy, and green. We are filling three gaps: building a local robot, testing if it works here, and showing its religious value. This is what makes our work different.

3. Methodology

3.1 Research Design

We used a mix of numbers and stories. Quantitative data gave us the hard facts on what people liked. Qualitative interviews gave us the "why" behind those numbers. This two-pronged approach ensures we don't miss the human element of engineering. The survey asked about usability and cost. We used statistics to find the patterns. Then, we sat down with experts to get their honest critiques. This balanced view is essential for any new invention.

3.2 Research Framework

We had three targets:

RO1: Check the demand in Brunei.

RO2: Build the actual robot.

RO3: See what users think of the prototype.

These goals kept us on track. We didn't just want a cool gadget; we wanted a useful tool. The whole process moved from identifying a need to testing the solution.

3.3 ADDIE Development Model

We followed the ADDIE steps: Analyze, Design, Develop, Implement, and Evaluate. It is a standard way to make sure you don't skip important details.

Analysis Phase

We looked at Brunei's farms. The big issues were labor and high costs. This proved we needed an automated, solar-powered fix.

Design Phase

The robot had to be solar, autonomous, easy to use, and cheap. We kept it modular so it could be upgraded later.

Development Phase

This was the building stage. We put together a platform that could sow seeds on its own. The parts included:

- Solar panels
- Batteries
- ESP32 brain
- Motors and drivers
- Seed hoppers and rakes
- A camera for remote viewing

Implementation Phase

We showed the robot to farmers and engineers. They got to play with it and see it move. We checked how well it handled seeds and how responsive the controls were.

Evaluation Phase

This was the final test. We used surveys to see if it hit the mark. People rated it on performance and price.

3.4 Prototype Development

The robot is a proof of concept. It shows that you don't need a million dollars to build something smart. The workflow is simple:

- The sun charges the battery.
- The battery runs the brain and motors.
- The brain tells the robot where to go and when to drop a seed.
- A rake covers the seed with dirt.
- The farmer watches everything through a live feed.

3.5 Participants and Data Collection

Once the robot was ready, we gathered our data. We used two main tools. The questionnaire covered the basics like performance and sustainability. The interviews went deeper into the technical side and the potential for selling the robot locally.

3.6 Data Analysis

We used percentages for the survey. For the interviews, we looked for themes. Three big topics kept coming up: how well it works, how much it costs, and how easy it is to drive. Performance was the top priority for almost everyone.

3.7 Ethical Considerations

Everyone who helped was a volunteer. We kept their names private. They knew they could leave the study whenever they wanted. We followed all the rules of academic honesty to make sure our findings are trustworthy.

4. Findings and Discussion

4.1 Demand for Solar-Powered Seed Sowing Robots

People in Brunei want this tech. Our research shows a high level of interest in anything that makes farming easier. It isn't just about the robot; it is about moving the whole country forward.

The data says farmers see this as a way to modernize. They are tired of old, slow methods. Interviews showed that people are becoming more comfortable with AI and tech in general. This makes it the perfect time to launch an agricultural robot.

4.2 Development of the Solar-Powered Seed Sowing Robot

We proved you can build a functional robot using off-the-shelf parts. Using an ESP32 and basic DC motors keeps the price down. The most important part is the solar integration. It shows that we don't need gas to grow food. This prototype is just the start.

4.3 User Feedback on the Developed Prototype

We broke the feedback into three piles.

- **Performance: 57.1%**
- **Cost: 22.2%**
- **User-Friendliness: 20.6%**

4.3.1 Performance

This was the big one. People loved that it could sow seeds without help. It clearly saves time and effort. However, some pointed out that it needs to be faster and handle rougher ground. These are the things we will fix in version 2.0.

4.3.2 Cost

Money matters. While the robot saves money on fuel and labor, the upfront cost is still a worry for small farms. We need to find ways to make the parts even cheaper or look into government subsidies.

4.3.3 User-Friendliness

Most found it easy to use. In an age of smartphones, driving a robot via a screen feels natural. But we still need better manuals and maybe some video tutorials for people who aren't tech-savvy.

4.4 Discussion: Technology, Sustainability, and Islamic Values

The robot is a success, but its meaning goes deeper. It fits perfectly with Islamic ethics.

Amanah (Responsibility)

Using the sun is the responsible choice. It shows we aren't just taking from the earth; we are respecting its limits.

Khalifah (Stewardship)

By cutting pollution, we are being better guardians of the planet. This is a religious win.

Ihsan (Excellence)

We didn't settle for a mediocre design. Striving for a high-tech solution is a way of practicing excellence in our work.

Maslahah (Public Benefit)

If this robot helps a village grow more food, it has served its purpose. Public welfare is the ultimate goal of any invention.

Da'wah Through Action

This project proves that a circuit board can be a tool for faith. By solving real problems, we show that Islam is relevant and helpful in the modern world. This is Da'wah in its **most practical form**.

4.5 Overall Significance of the Study

The robot works and people like it. We have shown that Brunei can build its own smart farming tools. More importantly, we have shown that these tools can carry a deeper ethical message. This is a new way of looking at both engineering and religion.

5. Conclusion

This study looked at a solar-powered robot as a tool for both farming and faith. We built it, tested it, and the results are clear: it is a viable path forward for Brunei. We hit all our goals. The prototype proves that automation and solar power belong together. Users liked the efficiency and the green energy. While we need to work on the speed and the price, the foundation is solid. Performance is what farmers care about most, so that will be our focus moving forward.

Beyond the nuts and bolts, this project is about ethics. By using Amanah and Khalifah as our guide, we created something that respects the earth and the community. This is a form of Da'wah that speaks through action rather than just words. Finally, this work brings different worlds together. It connects engineering with Islamic studies and agriculture with sustainability. It shows that when we innovate with a conscience, everyone wins. This is the future of technology in the Muslim world.

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