

Smart Agriculture Techniques Using

Internet Of Things Er Amit Kumar, Er Pushkar Dixit and Dr Anuj Kumar Parashar

Abstract—With the rapid increase in the speed of the internet there are a lot of tasks that are preferred to be done over internet as it is fast and efficient. There has been a lot of development in the area of IoT in the last decade which has proven quite fruitful. The population is rapidly increasing and thus there exists a need for providing food for this population. We need innovation in agriculture too as there is precision in the method. Agriculture uses a large number of equipments and these can be connected and controlled over the internet.

I. INTRODUCTION

Internet of Things (IoT) is an advanced automation and analytics system which exploits networking, sensing, big data, and artificial intelligence technology to deliver complete systems for a product or service. These systems allow greater transparency, control, and performance when applied to any industry or system.

IoT systems have applications across industries through their unique flexibility and ability to be suitable in any environment. They enhance data collection, automation, operations, and much more through smart devices and powerful enabling technology.

Kevin Ashton, in a presentation to Proctor & Gamble in 1999, coined the term “Internet of Things“. Almost all, every area, every device, every sensor, every software are connected to each other. The ability to access these devices through a smartphone or through a computer is called IoT. These devices are accessed remotely. IoT is basically a platform where we connect everyday things embedded with electronics, software, and sensors to the internet enabling them to collect and exchange data. In this way, each of your devices will learning from the experiences of other devices, just like humans do. With IoT, the interdependence in the human will expand- i.e to interact, collaborate and contribute to things. The ‘Thing’ in IoT can refer to any device that might comprise of any kind of built-in-sensors with the ability to collect and transfer data over a network or internet without manual intervention.

II. INTERNET OF THINGS

A. IOT Applications

Healthcare Application: These days we have digital watches and fitness monitoring devices that have changed the ways of healthcare monitoring. People can now monitor their own health at regular intervals of time. These days if a person is

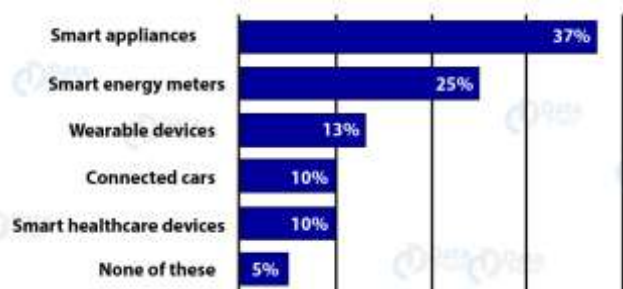
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being rushed to the hospital by an ambulance, his/her healthcare statistics are already given to the doctor, and the treatment gets started well in time. Data collected from different patients is now being put to use for the cure.

Energy Applications: The energy rates have become paramount. All Individuals and organizations, both are searching ways to reduce and control the consumption of energy. IoT provides a way to monitor energy usages not only at the appliance-level but also at the grid level, house-level or even at the distribution level. Smart systems such as Meters & Smart Grids are installed at various organizations to monitor energy consumption.



Education: IoT’s yet another great application lies in the field of education. IoT helps in fulfilling the gaps and loopholes in the education industry. It improves the quality of education being offered to students by optimizing the cost. It also improves the administration and the management by taking into consideration students’ response and performance.

Government: The smart city initiative by our government is an example of how efficient and big this technology is. Its incorporation in sectors like transportation, healthcare, armed forces and security can increase importance in the coming years.

B. Agriculture

The Internet of Things (IoT) has the capability to transform the world we live in; more-efficient industries, connected cars, and smarter cities are all components of the IoT equation. However, the application of technology like IoT in agriculture could have the greatest impact.

The global population is set to touch 9.6 billion by 2050. So, to feed this much population, the farming industry must embrace IoT. Against the challenges such as extreme weather conditions and rising climate change, and environmental impact resulting from intensive farming practices, the demand for more food has to be met.

Smart farming based on IoT technologies will enable growers and farmers to reduce waste and enhance productivity ranging

from the quantity of fertilizer utilized to the number of journeys the farm vehicles have made.

So, what is smart farming? Smart farming is a capital-intensive and hi-tech system of growing food cleanly and sustainably for the masses. It is the application of modern ICT (Information and Communication Technologies) into agriculture.

In IoT-based smart farming, a system is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, etc.) and automating the irrigation system. The farmers can monitor the field conditions from anywhere. IoT-based smart farming is highly efficient when compared with the conventional approach.

The applications of IoT-based smart farming not only target conventional, large farming operations, but could also be new levers to uplift other growing or common trends in agricultural like organic farming, family farming (complex or small spaces, particular cattle and/or cultures, preservation of particular or high quality varieties etc.), and enhance highly transparent farming.

In terms of environmental issues, IoT-based smart farming can provide great benefits including more efficient water usage, or optimization of inputs and treatments. Now, let's discuss the major applications of IoT-based smart farming that are revolutionizing agriculture.

III. APPLICATIONS OF IOT IN AGRICULTURE

A. Precision Farming

Also known as precision agriculture, precision farming can be thought of as anything that makes the farming practice more controlled and accurate when it comes to raising livestock and growing of crops. In this approach of farm management, a key component is the use of IT and various items like sensors, control systems, robotics, autonomous vehicles, automated hardware, variable rate technology, and so on.

The adoption of access to high-speed internet, mobile devices, and reliable, low-cost satellites (for imagery and positioning) by the manufacturer are few key technologies characterizing the precision agriculture trend.

Precision agriculture is one of the most famous applications of IoT in the agricultural sector and numerous organizations are leveraging this technique around the world. CropMetrics is a precision agriculture organization focused on ultra-modern agronomic solutions while specializing in the management of precision irrigation.

The products and services of CropMetrics include VRI optimization, soil moisture probes, virtual optimizer PRO, and so on. VRI (Variable Rate Irrigation) optimization maximizes profitability on irrigated crop fields with topography or soil variability, improve yields, and increases water use efficiency.

The soil moisture probe technology provides complete in-season local agronomy support, and recommendations to

optimize water use efficiency. The virtual optimizer PRO combines various technologies for water management into one central, cloud based, and powerful location designed for consultants and growers to take advantage of the benefits in precision irrigation via a simplified interface.

B. Agricultural Drones

Technology has changed over time and agricultural drones are a very good example of this. Today, agriculture is one of the major industries to incorporate drones. Drones are being used in agriculture in order to enhance various agricultural practices. The ways ground-based and aerial based drones are being used in agriculture are crop health assessment, irrigation, crop monitoring, crop spraying, planting, and soil and field analysis.

The major benefits of using drones include crop health imaging, integrated GIS mapping, ease of use, saves time, and the potential to increase yields. With strategy and planning based on real-time data collection and processing, the drone technology will give a high-tech makeover to the agriculture industry.

PrecisionHawk is an organization that uses drones for gathering valuable data via a series of sensors that are used for imaging, mapping, and surveying of agricultural land. These drones perform in-flight monitoring and observations. The farmers enter the details of what field to survey, and select an altitude or ground resolution.

From the drone data, we can draw insights regarding plant health indices, plant counting and yield prediction, plant height measurement, canopy cover mapping, field water ponding mapping, scouting reports, stockpile measuring, chlorophyll measurement, nitrogen content in wheat, drainage mapping, weed pressure mapping, and so on.

The drone collects multispectral, thermal, and visual imagery during the flight and then lands in the same location it took off.

C. Livestock Monitoring

Large farm owners can utilize wireless IoT applications to collect data regarding the location, well-being, and health of their cattle. This information helps them in identifying animals that are sick so they can be separated from the herd, thereby preventing the spread of disease. It also lowers labor costs as ranchers can locate their cattle with the help of IoT based sensors.

JMB North America is an organization that offers cow monitoring solutions to cattle producers. One of the solutions helps the cattle owners observe cows that are pregnant and about to give birth. From the heifer, a sensor powered by battery is expelled when its water breaks. This sends an information to the herd manager or the rancher. In the time that is spent with heifers that are giving birth, the sensor enables farmers to be more focused.

D. Smart Greenhouses

Greenhouse farming is a methodology that helps in enhancing the yield of vegetables, fruits, crops etc. Greenhouses control

the environmental parameters through manual intervention or a proportional control mechanism. As manual intervention results in production loss, energy loss, and labor cost, these methods are less effective. A smart greenhouse can be designed with the help of IoT; this design intelligently monitors as well as controls the climate, eliminating the need for manual intervention.

For controlling the environment in a smart greenhouse, different sensors that measure the environmental parameters according to the plant requirement are used. We can create a cloud server for remotely accessing the system when it is connected using IoT.

This eliminates the need for constant manual monitoring. Inside the greenhouse, the cloud server also enables data processing and applies a control action. This design provides cost-effective and optimal solutions to the farmers with minimal manual intervention.

Illuminum Greenhouses is a drip installation and Agri-Tech greenhouse organization and uses new modern technologies for providing services. It builds modern and affordable greenhouses by using solar powered IoT sensors. With these sensors, the greenhouse state and water consumption can be monitored via SMS alerts to the farmer with an online portal. Automatic Irrigation is carried out in these greenhouses.

The IoT sensors in the greenhouse provide information on the light levels, pressure, humidity, and temperature. These sensors can control the actuators automatically to open a window, turn on lights, control a heater, turn on a mister or turn on a fan, all controlled through a WiFi signal.

IV. CONCLUSION

Thus, the IoT agricultural applications are making it possible for ranchers and farmers to collect meaningful data. Large landowners and small farmers must understand the potential of IoT market for agriculture by installing smart technologies to increase competitiveness and sustainability in their productions. The demand for growing population can be successfully met if the ranchers as well as small farmers implement agricultural IoT solutions in a successful manner. The demand for growing population can be successfully met with IoT

V. REFERENCES

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