

Standard IX

Action Research Project

Topic for 2022–2023

Living in Harmony with Nature using IoT (Internet of Things)

Introduction:

Earth is the only planet where drinking water is available through natural sources. Also, it is the source for air, food, shelter, sunlight, household materials, medicinal plants, and other required things for the survival. It also provides us energy building materials like timber. The environment and climate on the Earth are regulated by different ecosystems. Excessive use of natural resources by the mankind leads to increase in carbon footprint, global warming, and pollution. It is our responsibility to save the ecosystem from pollution and help reduce excessive use of natural resources.

Due to the production of unlimited consumer and luxury goods, the Earth is in danger. So, it is our duty to save the Earth. We can exist only if the Earth exists. Therefore, to live in harmony with nature balancing the Earth's environment is the need of the hour.

What can we do to save our Earth? We can try to contribute our share by using new and innovative technology. Therefore, let us try to save our Mother Earth by using IoT (Internet of Things) and live in harmony with nature.

IoT is a technological revolution. We can be eco-supportive and eco-friendly if we can conserve our environment with the help of IoT. In the context of Indian socio-economic system, the technological revolution of IoT

plays an important role. In future, this technology will be useful in computing and communication. This dynamic and novel technical innovation is useful in the field of green environment.

For the benefits of citizens and society and for keeping harmony with nature with respect to Indian domain, IoT will be useful for carrying out research in the following areas:

1. Agriculture
2. Health
3. Natural disasters
4. Transportation
5. Water quality
6. Waste management
7. Smart cities
8. Automobile and many more.

The goal of our action research topic is to concentrate on Green IoT (Internet of Things) and promote energy efficiency in future. Thus, IoT (Internet of Things) is central and exciting research area encompassing many fields in Information and Technology. The phrase Internet of Things – also known by its acronym IoT. A 'Thing' in the 'Internet of Things' can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low or any other natural or man-made object that

can be assigned an Internet Protocol (IP) address and is able to transfer data over a network.

Definition of IoT:

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals, or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

Internet of Things (IoT) involve three distinct stages:

Stage 1: Sensors collect the information and converts into a set of data which we can process further for analysis.

Stage 2: The collected information is processed for further analysis with the help of sophisticated IT systems and applications.

Stage 3: In the last stage, data is processed in depth in the data centres for predictive analysis.

Requirements for (IoT):

There are three components which are required for (IoT) -

- 1. Hardware:** Consists of sensors, IP cameras and other communication hardware.
- 2. Middleware:** Includes storage and computing tools for data analysis.
- 3. Presentation:** A mix of applications and interpretation tools

What students have to do?

Think about how IoT can help us in building smarter, cleaner, and more efficient solutions. IoT (Internet of Things) connects everything and everyone in the smart world. Look for problems around your school, housing society or suburb; read more about

the topic and look for innovations that are eco-friendly or based on a sustainable way, taking an energy saving approach and involving Green IoT.

The action research topic should be 'SMART' meaning:

- S - Specific
- M - Measurable
- A - Attainable
- R - Realistic
- T - Time bound

To conduct the action research, students can use experimental, survey, mathematical, comparative, or mixed model as a standalone or in combination. The research must involve following points:

1. Collection of data
2. Interpretation of Data
3. Conclusion of the problem
4. Suggestions or solutions, if any

Some of the broader theme areas, which are listed below, might help you in selecting your topic for action research.

Smart City:

To set up an eco-friendly, green city, students can develop a model of Smart City which include deployment of (IoT). The model should cover any one of the following concepts:

1. Smart lights (to reduce the carbon footprint)
2. Smart traffic management (to reduce pollution)
3. Smart buildings (to inculcate green building practices)
4. Smart parking systems (to reduce pollution and enhance user experience)

Smart Water Management:

Drinking water is a limited source on Earth. Students can come up with ideas to stop the transportation wastage and reduce water pollution using IoT. Following concepts can be worked out:

1. Potable water monitoring tool to check the quality of tap water in a public or private institution.
2. Drinking water quality control system in a school, a housing society or at a public place.
3. Remote water monitoring solution that ensures clean water in a particular area
4. A project to detect real-time leakages in water supply
5. A project to detect untreated industrial water into river or sea
6. A project to monitor water level variations in dams
7. A project to manage water-clogging in urban/rural areas

Smart Environment:

Student can develop innovative ideas for a green, clean, pollution-free environment to live in harmony with ecosystem. A few ideas are listed below:

1. A project to build a system using mathematical model to control the emission of Carbon dioxide from factories
2. A project to build a system to check or reduce vehicle emissions
3. Congestion and pollution management for eco-friendly environment

Smart Waste Management:

Any of the following projects can be selected to manage the city waste and contribute to the Government of India's initiatives viz. Swachh Bharat and Clean City, Green City:

1. A project to smartly manage civic sanitation systems by installing sensors to issue alerts for choked up drainpipes.
2. A project for smart segregation of dry and wet waste for school or housing society premises using IoT.

Smart Agriculture:

With the exponential growth of world population, the world will need to produce 70% more food in 2050, shrinking agricultural lands, and depletion of finite natural resources, the need to enhance farm yield has become critical. Limited availability of natural resources such as fresh water and arable land along with slowing yield trends in several staple crops, have further aggravated the problem. Students can think of IoT solutions which may help farmers close the supply demand gap, by ensuring high yields, profitability, and protection of the environment.

1. A project to create a model for precision farming which uses data analytics for following:
 - a. Soil testing
 - b. Moisture testing
 - c. Earth density modelling
 - d. Pest detection and control
2. A project to build IoT-based system to update farmers for better crop management.
3. Deploying sensors to monitor the growth and health of the crop
4. Deploying a system to monitor food warehouses for leakages, wastages, and termite attacks.

Other topics:

1. Smart microwave oven to determine the optimum temperature and time to avoid under/over-cooking.
2. Smart solution for climate change.

3. IoT-based system to reduce emissions from battery-operated vehicles.
4. Smart electric vehicle (EV) charging infrastructure and grid solution.

How to write the action research report?

- **Title:** 'SMART' Agriculture System using IoT.
- **Hypothesis:** IoT can be effectively used to increase per acre yield
- **Methodology:** Use the suitable type of research methodologies for the selected topic.

An example:

Title: Use of Internet of Things (IoT) for Healthcare System

Introduction:

IoT enables healthcare professionals to be more watchful and connect with the patients proactively. Data collected from IoT devices can help physicians identify the best treatment process for patients and reach the expected outcomes. Devices in the form of wearables like fitness bands and other wirelessly connected devices like blood pressure and heart rate monitoring cuffs, glucometer etc. give patients access to personalized attention. These devices can be tuned to remind calorie count, exercise check, appointments, blood pressure variations and much more. Apart from monitoring patients' health, there are many other areas where IoT devices are very useful in hospitals. IoT devices tagged with sensors are used for tracking real time location of medical equipment like wheelchairs, defibrillators, nebulizers, oxygen pumps and other monitoring equipment. Deployment of medical staff at different locations can also be analyzed real time.

Methodology: Sensors are used to sense and capture the information regarding patient's health/disease and receive necessary data. Here all physical objects are connected to the Internet, and devices display continuous process monitoring. The required medical information is well provided.

IoT in healthcare:

1. **Big data:** Big data in healthcare is a term used to describe massive volumes of information created by the adoption of digital technologies that collect patients' records and help in managing hospital performance, otherwise too large and complex for traditional technologies. e.g. The line of treatment and medications used for COVID-19 patients of varied parameters (age, gender, ailments etc.) can be captured, processed and analysed easily using Big Data technologies for future decisions.
2. **Cloud computing:** Cloud computing in healthcare describes the practice of implementing remote servers accessed via the internet to store, manage and process healthcare-related data. Cloud storage offers a flexible solution that allows healthcare professionals and hospitals to leverage a network of remotely accessible servers.
3. **Smart sensors:** Smart sensors offer novel solutions to several challenges in healthcare, such as early detection of pathologies, or minimally invasive management and prevention of high-burden diseases like cardiovascular diseases and cancer. The development of lightweight, smart sensors-based systems also enables continuous monitoring of patients' health parameters.

4. Software: Healthcare software is used to monitor, analyze and interpret a patient's medical state based on previous records and real-time monitors, as well as perform a range of other functions to help medical professionals provide the best treatment possible. Healthcare and medical software solutions are typically developed for simulation and medical training, research, diagnosis, database storage and equipment planning.

5. Artificial intelligence (AI): AI in healthcare can enhance preventive care and quality of life, produce more accurate diagnoses and treatment plans, and lead to better patient outcomes overall. AI can also predict and track the spread of infectious diseases by analyzing data from a government, healthcare, and other sources.

6. Actuators: An actuator is a mechanism which introduces the motion and controls the system to act upon in a given environment. The main applications of the medical actuators are to maintain accuracy and control required parameters.

References:

1. Asajpour M, Pouriye S, Parizi RM, Dorothy M, Valero M, Arabnia HR. *Internet of Things for current COVID-19 and future pandemics: an exploratory study. J Healthc Inf Res.* 2020 Nov 12:1–40.
2. Liu Y, Dong B, Guo B, Peng W. *Combination of cloud computing and Internet of things (IoT) in medical monitoring systems. Int J Hospit Inf Technol.* 2015;8(12): 367–376.
3. Shin D, Hwang Y. *Integrated acceptance and sustainability evaluation of Internet of Medical Things: a dual-level analysis. Internet Res.* 2017; 27(5):1227–1254.
4. Rahman MS, Peeri NC, Shrestha N, Zaki R, Haque U, Ab Hamid SH. *Defending against the novel coronavirus (COVID-19) outbreak: how can the internet of things (IoT) help to save the world? Health Pol Technol.* 2020 Apr 22.

■