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Project Group ID - 11

Hydroponics Based Precision Farming using – Approach

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Overview :

1. Literature Review
2. Market Survey
3. Component Survey

Literature Review:

Sr. No.	Year of Publication	Title and Name of Authors'	Main Findings	Methodology	Limitations/ Gap
1.	2013	"A Development of an Automatic Microcontroller System for Deep Water Culture (DWC)" M.F. Saaid, N.A.M. Yahya, M.Z.H. Noor, M.S.A. Megat Ali.	The study has developed a systematic procedure to calculate the needed PH liquid to up and down the pH level of liquid they have considered users of water of 300 ml they have done a systematic study to see how much pH controls it's needed accurately control pH value.	The methodology in this project consists of six stages namely details of study, hardware identification, software identification, hardware and software interfacing, analysis and troubleshooting, data and result collection.	This paper has most into the calibration of pH value rather than focusing on plant growth though it might be considered that's 2013 paper the focus was not much on plant growth but rather the parameter Calibration.
2.	2013	"Automated Indoor Aquaponic Cultivation Technique " by M.F. Saaid, N. S. M. Fadhil, M.S.A. Megat Ali, M.Z.H. Noor.	The Automated Indoor Aquaponic Cultivation Technique was able to perceive a good control performance. The overall integration of controller, actuators and sensors effectively create a closed-loop control system. The temperature sensor DS18B20 was able to monitor the water temperature variation in the aquarium and let the user analyze it.	Methodology implemented in this paper contains six stages. Process flow methodology starts from the description of work to be done, the brainchild of new or previous working reference right up to the stage of analyzing the data that was collected.	It mostly worked on a small scale. It also did not completely automate the whole process but only automated the process of temperature control, feeding mechanism the overall monitoring forces still need to be Implemented by a person present .

Sr. No.	Year of Publication	Title and Name of Authors'	Main Findings	Methodology	Limitations /Gap
3.	2015	"Automated pH Controller System for Hydroponic Cultivation" by Saaid, M.F., Sanuddin, A., Megat Ali, M.S.A. I.M Yassin.	Development of an automatic pH level controller system for deep water cultivation (DWC) technique using Arduino Mega 2560 as microcontroller was successfully done. The system successfully dropped the pH solution (Up/Down) into the water solution in case to maintain the pH value. Besides that, this system also successfully ensures the level of water solution would be transferred to the hydroponics container at a desired level.	They used various branded pH sensors to completely calibrate and test the system that implemented embedded system to control pH level for hydroponic system, They have Shown data for calibration of the system.	System itself was quite bulky as well as not scalable or applicable for a large scale hydroponics project .
4.	2016	"Integrating scheduled hydroponic system," by S. Uma Maheswari, A. Preethi, E. Pravin and R. Dhanusha.	The proposed hydroponic system integrates different crop varieties and overcomes the existing systems limitation. It approach regulates the system, resulting in faster plant growth with minimal nutrient requirements and fewer chemical constituents. This system is cost-effective, eco-friendly, and efficient compared to other farming techniques, making it an encouraging alternative.Traditional plants were compared with those grown under this system, and the results showed significant benefits.	Well defined sensing and control system for project. Also, comparative study.	Design seems to be less efferent in use of its system resources.

Sr. No.	Year of Publication	Title and Name of Authors'	Main Findings	Methodology	Limitations/ Gap
5.	2017	"Design of Fully Automated Low Cost Hydroponic System using Labview and AVR Microcontroller" Saket Adhau, Rushikesh Surwase, KH Kowdiki.	The system shows great stability and smooth control actions when controlled by PID controller.	Use a complex labVIEW based wireless system to monitor plant growth. The system uses various sensors coupled with ZigBee or similar wireless protocols to wirelessly send/receive data and NI-DAQ cards for hardware and software interface.	Although the system has been said to have done experiments in test for their proposed system, the data of it has not been shown, it still leaves doubt about the claim that no monitoring has been needed for the system.
6.	2017	"Hydroponic Smart Farming Using Cyber Physical Social System with Telegram Messenger" Robert Eko Noegroho Sisyanto, Suhardi, Novianto Budi Kurni.	With the monitoring system through this CPSS, it allows hydroponic farmers wherever and whenever to know the condition of plants in real-time. Telegram-Bot made python based using the Telegram Messenger platform. Monitoring conducted in this research includes monitoring of light, room temperature, humidity, pH, EC and the temperature of solution or nutrients.	This research used system engineering as its methodology. Systems engineering is a guide to a complex system. System engineering not only focuses on the design of a system, but also external factors of the system. It has three phases: concept development, engineering development, and post development.	This study has several limitations, including the need for an internet connection to monitor hydroponic crops, and the need for additional output from relays such as humidifiers to increase moisture. While also as a whole this project focuses more on telegram integration and market survey and analysis.

Sr. No.	Year of Publication	Title and Name of Authors'	Main Findings	Methodology	Limitations/ Gap
7.	2017	"Nutrient Film Technique (NFT) Hydroponic Monitoring System Based on Wireless Sensor Network" Helmy, Marsha Gresia Mahaidayu, Arif Nursyahid, Thomas Agung Setyawan, Abu Hasan.	This paper shares calebrative result for pH sensor EC sensor TDS answer with the respective meter readings, it is also used in XBee based wireless sensor network which was able to successfully establish an error free and noise handling connection network that was implemented successfully remotely.	The monitoring system for lettuce cultivation hydroponic outdoor type NFT using wireless sensor network. In this system, there are two hydroponic modules called greenhouse. Greenhouse is used to be the end node in the wireless sensor network system. Sensors will be placed in the nutrition tank depending on connection , data will be sent to the Xbee end node.	Much detail of their sensor network was not explained quite well, applicability of their sensor network was also not well explored.
8.	2017	"Hydroponics Farming" by Mr.Rahul Nalwade, Mr.Tushar Mote.	Hydroponically developed plants are too impervious to water with a high salt substance. Another advantage incorporates not having creepy crawlies, creatures, and infections for example, growths effectively exhibit in the developing medium.	This paper used non Non circulatory method and root dipping method for hydroponics parameters like pH EC light and temperature were considered , and gsm based monitoring.	The paper showed mostly a conceptual & experimental implementation was on non product based but simply a fact verifying based experiment CEL test, no new techniques were used to make system intelligent.

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9.	2017	"A Compact Hardware Design of a Sensor Module for Hydroponics" Tomohiro Nishimura†, Yuji Okuyama‡, Ayaka Matsushita†, Hiromichi Ikeda†, and Akashi Satoh.	A compact sensor module for hydroponics that measures the nutrient concentration and water level using simple oscillator circuits.Oscillation frequencies are measured and are found to change in response to the resistance and capacitance between metal wires on a printed circuit board submerged in liquid fertilizer.	The structure and operating principles of the sensor circuit is described, and its performances are demonstrated through experiments.	Need pcb design skills to actually use and apply new module design.
10.	2017	"A Smart Hydroponics Farming System Using Exact Inference in Bayesian Network" Melchizedek I. Alipio∗, Allen Earl M. Dela Cruz†, Jess David A. Doria‡ and Rowena Maria S. Fruto.	The work design & implement a smart NFT hydroponics farm using inference from Bayesian Network. The sensor network composed of pH, light intensity,electrical conductivity water temperature were used to gather data from the farm. Data received from sensors are processed & are sent to an IoT platform.& it also used to generate BNs which then performs predictive analysis that gives output decisions to autonomously control the system.	This system started its implementation through a high level design development of the system afterwards software flow development.The authors consider the system for a scalable Farm model, sensor network was also developed , To get data from sensor network, cloud interfacing and user interface were both connected and analytics of the data was done.	Since this ai based systems , its gathering was not descued as well as expected.

Sr. No.	Year of Publication	Title and Name of Authors'	Main Findings	Methodology	Limitations/ Gap
11.	2018	"Automatic Control of Electrical Conductivity and PH Using Fuzzy Logic for Hydroponics System" by Mathawee Fuangthong,Part Pramokchon.	This research introduces an expert system for the concept of hydroponic control. The fuzzy logic control is used in the decision-making process of pH and EC, which can work well for humans. This experiment adjusts the pH and EC to the optimum range for green oaks. The results show that the use of fuzzy logic control can better control the adding nutrients to plants. Reduce the amount of nutrient solution and reduce the workload.	It used Dynamic fruit floating technique as the characteristic choice of hydroponic system variant. They have used Fuzzy logic for PH and electrical conductivity control ,They have explained the working of the fuzzy logic export system and shared complete data used in the implementation.	This system was only implemented for green oak , & the parameter considered is only PH & EC value, it also select temperature, humidity, Have not been considered since this parameters a very important, universality of the system can still be argued against.
12.	2018	"Internet of Things - Based Mobile Application for Monitoring Automated Aquaponics System" Flordeliza L.Valiente, Ramon G. Garcia, Ellaine Joy A. Domingo,Scott Martin T. Estante, Erika Joanna L. Ochaves, Julian Clement C. Villanueva, Jessie R. Balbin.	Automated Aquaponics System with Access and Control of pH Level and Temperature through Internet of Things with the Use of Intel Edison" utilizes the monitoring and controlling of the parameters to maximize the growth for the fish and plants using Intel Edison. The automation for the aquaponics system was done to make a simulated environment.	It use app procedural methodology where they started with conceptual development hardware, software and testing procedure for various parameter of the system & implementation and testing at the end.	The system was constructed as a simulated environ-ment to show implementation of iot in Aquaponics but since it is a very large scalable field, the architecture necessary in iot implementation was not discussed for scalability.

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13.	2019	"Utilization of Tofu Wastewater for The Growth of Red Spinach (Alternanteraamoena voss) in Floating Raft Hydroponic Cultures" by W Anggraini1, M Zulfa1, N N Prihantini2, F Batubara3, Ririn Indriyani.	This study explains liquid waste fertilizer affects the growth of red spinach plants (Alternanthera Amoena Voss) in the floating raft hydroponic technique which is a parameter of stem height, number of leaves, leaf width and root length.	This study used a Completely Randomized Design (CRD) consisting of 4 concentration treatments, namely 30%, 45%, 60%, and 1 control using AB mix nutrition for each treatment 3 times repetition of nutrient solutions derived from liquid waste tofu which had been fermented into organic fertilizer for 10 days.	No special improvement other nutrients.
14.	2019	"A Controlled Environment Agriculture with Hydroponics: Variants, Parameters, Methodologies and Challenges for Smart Farming" by Srivani P,Yamuna Devi C,Ma.	This paper mostly Deals with a induct research of hydroponics systems variants based on the control environment like NFT system. DWC, Wick system, and aeroponics system, it also goes in detail to explain parameters like temperature, pH, EC many more. It also explain Cloud techniques data processing system techniques sensor techniques and challenges Power optimization energy saving.	Methodology They have done and extensive research from old fields of scientific frontiers in agriculture domain they have looked into analysis done by various International and public sector organisation and review that data They can said to have use serving technique of research.	Just being that this paper is a conference paper which have looked into everything that has been done till now in this do me while the standard has been very high since this has been Ieee conference paper.

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15.	2019	"Radish Sprout Growth Dependency on LED Color in Plant Factory Experiment "by Tatsuya Kasuga, Hidehisa Shimada, Kimio Oguchi.	This paper presented experiments that reveal which color of LED lighting best enhances the growth of cultured radish sprouts. if electrical power consumption is considered, it offered about twice the growth rate of the fluorescent lamp. Among the LEDs, blue LEDs showed the best performance.	It represents the systematic experimentation of array of plants and data collection parameters like height of plant, weight of plant, no of leaves etc.	Their study is however is only limited to radish sprout, but this plans on using their methodology look into the the leds color namely blue & red and quantify its effect on our spanish growth.
16.	2019	"An Automated Hydroponics System Based on Mobile Application" Kuyateh Kuyateh, Udomlux Ampant, and Nutthaphol Kongrodj.	This research aims to enhance the convenience and productivity of hydroponic vegetable planting by developing an automatic hydroponics vegetable system that can be controlled and monitored via IoT and a mobile phone. The paper also includes the implementation of various tests such as functional requirements, usability, integrity, and security to ensure system reliability and functionality.	Well defined sensing and control system for project. Also used Black BOX testing software for functional requirements, usability, integrity, and security testing.	Seemed to have used market available parts too much, does not satisfy what one would consider as a product.

Sr. No.	Year of Publication	Title and Name of Authors'	Main Findings	Methodology	Limitations/ Gap
17.	2020	"An AI Based System Design to Develop and Monitor a Hydroponic Farm Hydroponic Farming for Smart City" Glenn Dbritto,Safa Hamdare	It describes how the mix of water, Light and nutrient solution will be automatically delivered to the roots of tomato plants by maintaining the pH level of the nutrient solution and temperature to optimize plant growth.	This started with comparative study of all the innovative systems that exist in this domain, over 9 of them were considered. Development of the system was procedural. They use label based description rather than numerical ranges for the parameter values.	Like what one would expect from their title AI was not used in employment and growth of the hydroponic system, rather when the AI model was designed using the data collected from there procedure.
18.	2020	"Design, Construction and Testing of IoT Based Automated Indoor Vertical Hydroponics Farming" by Qatar Chowdhury, M.E.H.; Khandakar, A.; Ahmed, S.; Al-Khuzaei, F.; Hamdalla, J.; Haque, F.; Reaz, M.B.I.; Al Shafei, A.; Al-Emadi, N.	Full-scale implemented vertical hydroponics system with the system components elaborately mentioned along with cost and power consumption analysis while considering in-house farming.	Calibration and testing of the sensors and system modules were done and the system was used initially for planting mint from stem in an indoor area and later on, used to plant tomato, strawberry, mint, coriander, cucumber, capsicum, and lettuce. Step were taken to it be scalable.	Cost of there is project is too high for our budget. They used all standard materials from market. Primarily focused for gulf region, even though implementable across globe.

Sr. No.	Year of Publication	Title and Name of Authors'	Main Findings	Methodology	Limitations/ Gap
19.	2020	"Smart Hydroponics system integrating with IoT and Machine learning algorithm" Srinidhi H K,Shreenidhi H S,Vishnu G S	As the plant grows based on the KNN and LASSO regression algorithm it grows rapidly. Hence authors developed a product for plant analysis that can be adapted to a wide range of products like small personal devices to large scale farms enabling the possibility to accurately measure the growth and physical traits of the plant.	The Software Development Life Cycle methodology adopted in due course of this paper development is AGILE methodology. It is a fast-paced process where it promotes the continuous integration of development and testing throughout the software development life cycle of the project.It allows the teams to break the lengthy requirements, build, and test phases.	Expected outcome for these is that a plant growth analysis system would be developed & analyze all small plants.But it stills leaves room for discussion if this model can be appreciable to all plant or just similar type of plant and in their research and how much accuracy there will be.
20.	2020	"A Survey of Smart Hydroponic Systems" Falmata Modu1 ,Adam Adam*,1 , Farouq Aliyu2 , Audu Mabu1 , Mahdi Musa	This paper reviews smart hydroponic systems in the literature, focusing on monitoring & automation of nutrient supply. While proportional controllers are commonly used for nutrient supply automation, they are prone to oscillations.The paper also suggests that IoT is the most effective approach when interactivity is considered.	The paper itself was a survey that looked over a lot of available papers with good documentation and citations. Data they obtained was organised quite well.	They didn't go into the level of detail one would need when its project planning. Hence needed to go through various references.

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21.	2021	"Fuzzy Ponics: a Fuzzy Based System to Control Temperature,Relative Humidity, Electrical Conductivity and PH of Hydroponics" by Armie E. Pakzad 1*, Abbas Ali Pakzad 2	This paper focused on controlling the four important parameters for an effective HS namely, temperature, RH, for both warm and cool season crops and the nutrient solution's pH and EC. It also included light and dark cycle environmental assessment for both warm and cool season crops.	They created six Sugeno-style fuzzy inference systems for light and dark cycle environmental condition assessments for warm and cool season crops, and pH and EC conc.assessments using triangular and Singleton I/O AND O/P membership functions respectively.	Although optimized usage was analyzed and calculated , practically implementation was not done.
22.	2021	"Technological Influences on Monitoring and Automation of the Hydroponics System" Geetali Saha	This paper finding shoes the complete indepth research done by the author of various different type of hydroponics.This papers reviews from the basic setup used currently to the various biotic and abiotic factors associated with hydroponics as well as various variants of hydroponics use currently as well as various monitoring system and also does comparative review of the systems done till date by various authors in ieee conferences.	Surveying methodology.	It being a survey paper, also only a single author, so biasing in opinion can be a factor that affects the results.

Sr. No.	Year of Publication	Title and Name of Authors'	Main Findings	Methodology	Limitations/ Gap
23.	2021	"Fully Automated Hydroponics System for Smart Farming" Hariram M Shetty; Kshama Pai K, Navaneeth Mallya; I. J. Engineering and Manufacturing.	This paper describes the development of a fully automated hydroponics system that monitors and controls temperature, humidity, pH, and EC levels. While the system was successfully developed and serves as a proof of the project,further development is necessary to bring the system to a product level.	Well defined sensing and control system for project.	It is a prototype to exhibit sensing and control system.Not truly Scalable.
24.	2022	"Use of Various Types of Nutrition and Plant Regulatory Substances in Hydroponic Plants" by Ismalida M. Samihah, Ai Rohaeti, R. Susanti, Talitha Widiatningrum.	This paper presents a literature survey research where they have surveyed all the relevant nutrition journals and taken 53 most relevant of 70 found. Their study will help in considerations of various nutrients available in the market and make our work tailoring to it.	This paper presents a literature survey research where they have surveyed all the relevant nutrition journals and taken 53 most relevant of 70 found.	This is only a survey research paper that nutrients used in market.

Sr. No.	Year of Publication	Title and Name of Authors'	Main Findings	Methodology	Limitations /Gap
25.	2022	"Design and Implementation of Smart Hydroponics Farming Using IoT-Based AI Controller with Mobile Application System" by S. V. S. Ramakrishnam Raju ,1 Bhasker Dappuri ,2 P. Ravi Kiran Varma ,3 Murali Yachamaneni ,4 D. Marlene Grace Verghese ,5 and Manoj Kumar Mishra.	Presents a very good study of IOT automation as well disease detection using their own optimized algorithm predictive DLCNN, they serve as standard of reference when considering computational complexity which is much improved as compared to traditional ones used algorithms.	Considers computational complexity as performance parameter for their optimized algorithm predictive DLCNN, it also used a mobile based application we will also use GUI to support system.	This system can be extended with hybrid deep learning architectures and optimization methods.

Summary of Literature Survey

New technologies a have been researched and improvements have been done in following areas:

1. Nutrients composition
2. Nutrients supply
3. Light effect
4. ph and EC conditions
5. Use of ai has been done in to control nutrients, light , ec/tds ,ph

As this are the major scopes of research for plant growth, however they have not utilised techniques that will turn this technology into a feasible product , showing efficiency, and effectivity which tend to do.

Market Review:

Study Period	2017-2027
Market Size (2023)	USD 4.69 Billion
Market Size (2028)	USD 6.83 Billion
CAGR (2023 - 2028)	7.80 %
Fastest Growing Market	Asia Pacific
Largest Market	North America

Major Players

*Disclaimer: Major Players sorted in no particular order

Market Survey:

1. The Hydroponics Market size is expected to grow from USD 4.69 billion in 2023 to USD 6.83 billion by 2028, at a CAGR of 7.80% during the forecast period (2023-2028).North America Dominates the Market, while asia pacific is fastest growing in market [1].

2. It is set to grow rapidly on account of the surging implementation of this agricultural method in Australia, Japan, India, and China [2].

3. The global market is highly fragmented with the presence of multiple companies. Most of them are focusing on R&D activities to come up with state-of-the-art techniques for surging sustainability and saving costs [3].

4. March 2021: The state government of Ahmedabad announced its plan to accelerate hydroponic farming in cities to encourage households to grow vegetables in their homes. The agriculture department staff will provide hands-on training to residents with DIY videos [4].

Component Survey:

Reason for choosing a Microcontroller:

Feature	ESP32	ATmega328	ESP8266	Raspberry Pi Pico	PIC 18	STM32
Processing power	Dual-core 32-bit Xtensa LX6 up to 240 MHz	8-bit AVR RISC up to 20 MHz	Single-core 32-bit Tensilica LX106 up to 160 MHz	Dual-core ARM Cortex-M0+ up to 133 MHz	8-bit PIC RISC up to 20 MHz	32-bit ARM Cortex-M3 up to 72 MHz
Memory	520 KiB RAM, 4 MB ROM	32 KiB RAM, 32 KB ROM	320 KiB RAM, 448 KiB ROM	264 KiB RAM, 2 MB ROM	32 KiB RAM, 32 KB ROM	128 KiB RAM, 512 KB ROM
Wireless connectivity	Dual-mode Wi-Fi (802.11 b/g/n) and Bluetooth 4.2 (BLE)	Wi-Fi (802.11 b/g/n)	Wi-Fi (802.11 b/g/n)	None	None	Wi-Fi (802.11 b/g/n) and Bluetooth 4.2 (BLE)
Peripheral interfaces	34 GPIOs, 12-bit SAR ADC up to 18 channels, 2 DACs, 10 touch sensors, 4 SPI, 2 I²S, SD/SDIO/CE-ATA/MMC/eMMC host controller, SDIO/SPI slave controller, Ethernet MAC interface, CAN bus 2.0, infrared remote controller (TX/RX, up to 8 channels), motor PWM, LED PWM (up to 16 channels)	14 GPIOs, 10-bit ADC, 2 UART	11 GPIOs, 10-bit ADC, 1 UART	30 GPIOs, 12-bit ADC, 2 DACs, 2 I²C, 2 SPI, 1 UART	40 GPIOs, 10-bit ADC, 1 DAC, 2 UART, 2 SPI, 2 I²C, 2 CAN	51 GPIOs, 12-bit ADC, 2 DACs, 2 UART, 2 SPI, 2 I²C

Feature	ESP32	ATmega328	ESP8266	Raspberry Pi Pico	PIC 18	STM32
Power consumption	Typical: 80 uA (deep sleep), 800 uA (active), 1.2 mA (peak)	Typical: 800 uA (active), 1.2 mA (peak)	Typical: 1 mA (active), 2.5 mA (peak)	Typical: 250 uA (deep sleep), 1.2 mA (active), 2 mA (peak)	Typical: 1 mA (active), 2 mA (peak)	Typical: 1 mA (active), 2 mA (peak)
Cost	$10 - $15	$2 - $3	$5 - $10	$4 - $5	$5 - $10	$5 - $10

Conclusion:

The ESP32 is the recommended choice for the indoor hydroponic system due to its combination of dual-core processing, Wi-Fi, and Bluetooth capabilities, abundant GPIO pins, adequate memory, strong community support, and compatibility with popular development platforms like Arduino and PlatformIO. These features make the ESP32 well-suited for remote monitoring, complex automation, and efficient control in the hydroponic system.

Reason for Choosing Motor Driver:

Feature	L293D	L298N	DRV8825
Operating voltage	4.5V to 36V	4.5V to 46V	4.75V to 36V
Current handling	600mA per channel	2A per channel	2A per channel
Driver configuration	Quadruple half-H driver	Dual full-H driver	Single full-H driver
EMF protection	Internal	External	External
Suitable applications	Low-current motors, such as BO motors, DC-geared motors up to 500 RPM, and small stepper motors	High-torque and high-RPM motors, such as Johnson motors and high-torque DC geared motors	High-performance stepper motors
Cost	Low	Low	Medium

Conclusion:

The L293D motor driver is suitable for small to medium-scale applications requiring bi-directional control of DC motors. It is relatively easy to use and affordable. However, for larger-scale systems or applications requiring higher current handling or micro-stepping for smoother motion control, the L298N or DRV8825 might be more appropriate choices. The L298N provides higher current handling, while the DRV8825 is designed for precise control of stepper motors.

Reason for Choosing DHT 11:

Feature	DHT11	DHT22	SHT30	BME280
Cost	Very low	Low	Medium	High
Accuracy	2 degrees Celsius and 5% relative humidity	2 degrees Celsius and 5% relative humidity	0.1 degrees Celsius and 2% relative humidity	0.1 degrees Celsius, 2% relative humidity, 1 hPa pressure, and 1 meter altitude
Operating temperature range	0 to 50 degrees Celsius	0 to 50 degrees Celsius	-40 to 125 degrees Celsius	-40 to 85 degrees Celsius
Humidity range	0 to 95% non-condensing	0 to 95% non-condensing	0 to 100% non-condensing	0 to 100% non-condensing
Response time	20 milliseconds	20 milliseconds	10 milliseconds	30 milliseconds
Power consumption	500 microamperes	500 microamperes	1.3 milliamperes	1.7 milliamperes

Conclusion:

As you can see, DHT11 is the cheapest and easiest-to-use sensor on the list. Hence we would like to go with it as our requirements fit in DHT 11.

Reason for choosing LED lights:

Feature	WS2811	WS2812B
Number of LEDs	3	3
LED type	RGB	RGB
Operating voltage	12V	5V
Current draw	60mA per LED	60mA per LED
Data transmission speed	400kHz	800kHz
Data protocol	WS2811 protocol	WS2812B protocol
Maximum length	5 meters	10 meters
Lifespan	10,000 hours	20,000 hours
Cost	Less expensive	More expensive

Conclusion:

WS2812B has more lifespan and works on 5V hence we would like to go with it.

Difference Between CDS and Pbs LDR's

Feature	CdS	PbS
Photosensitive material	Cadmium Sulfide	Lead Sulfide
Operating temperature range	-40°C to 85°C	-50°C to 85°C
Sensitivity	1000 to 10,000 ohms per lux	100,000 to 1,000,000 ohms per lux
Response time	10 to 100 milliseconds	100 to 1000 milliseconds
Lifetime	10,000 to 100,000 hours	10,000 to 100,000 hours
Cost	Low	Moderate

Conclusion:

As you can see, CdS and PbS LDRs are very similar in terms of their operating temperature range, sensitivity, response time, and lifetime. However, there are a few key differences between them. CdS LDRs are less sensitive to light than PbS LDRs, but they have a faster response time. PbS LDRs are also more expensive than CdS LDRs. Since our budget is low, we would like to go with Cds

Reason for choosing a Water pump:

Feature	Micro DC Submersible Water Pump	Non Submersible Pump	Mini Brushless DC Water Pump
Flow rate	Up to 120 liters per hour	Up to 60 liters per hour	Up to 90 liters per hour
Lift height	Up to 1 meter	Up to 80 centimeters	Up to 80 centimeters
Power supply	DC 3-6V	DC 3-6V	DC 3-6V
Max current draw	200mA	200mA	200mA
Price	Low	Low	Low
Noise level	High	High	Low
Durability	Low	Low	High
Use cases	Fountains, aeroponics systems	Aquariums, Arduino projects	Arduino projects, small aquariums

Conclusion:

We would like to go with the Micro DC Submersible Water Pump as it has a higher flow rate and it can lift water to the height of 1 metre.

Overall Summary:

- Looking at the current market survey we realise that the future potential of hydroponics to make a lot of money as well as serve and help countries and its populus with poor environmental condition . mostly money through.

- Also current research work in this domain as has been to improve plant growth rather focusing on efficiency need for a product while our will focus on plant growth while giving features like better water utilization , power optimization and with effective nutrients supply bases on ai use tds as a parameter.

- Our product also has taken consideration for an effective and efficient system

Motivation:

- Government incentives
- Future market prospects
- Public sector help initiative
- Optimization of new technologies