ENVIRONMENTAL MONITORING

using

INTERNET OF THINGS

project

Green House Monitoring

by,

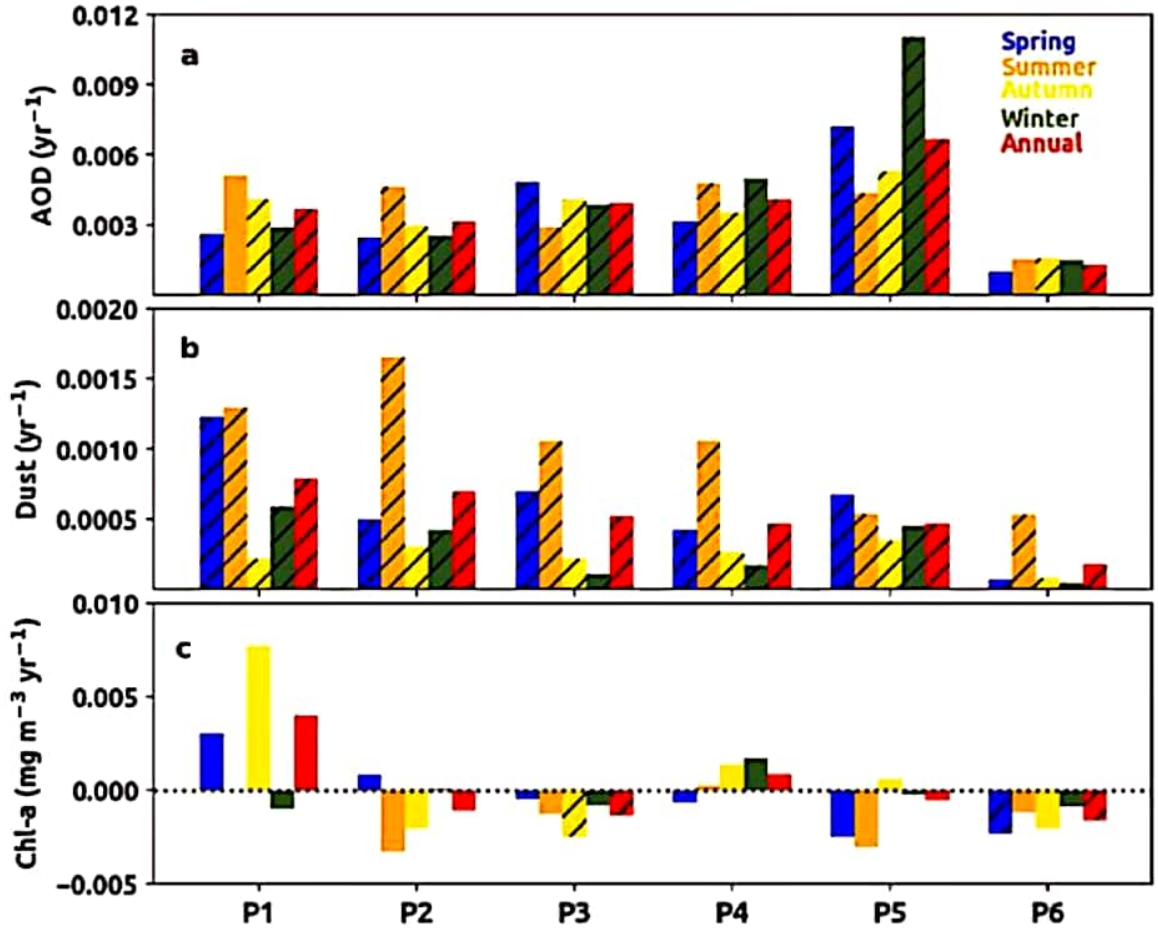
Asian College of Engineering and Technology

students

ENVIRONMENT MONITORING

Greenhouse Monitoring using Internet of Things

Greenhouse system is beneficial for rural areas agriculture sector because where almost all sectors going to automation like home, industry. Man power is reduce day by day. Where in agriculture sector today also use old technology. Greenhouse is artificial close shied In which we focus on monitoring and controlling the internal component of greenhouse. Greenhouse can observe and monitor by a single human. Greenhouse consist of different type of sensors like light sensor, temperature sensor, soil moisture sensor and also consist of Arduino Uno (microcontroller ATmega328). And also consist of cooling fan, artificial lights, watering system. All sensors are directly controlled by Arduino Uno. All sensors are connected to 6-analog pins of Arduino uno and collect the data from greenhouse and display on LCD. The automatically on cooling fan, artificial and watering system for maintain the efficiency of greenhouse, when any Thing will shortage like oxygen level in soil, temperature level in greenhouse or chlorophyll. LCD and LED are connected to 14-digital pins of Arduino uno.



A control system can then use this information to make regular adjustments to equipment settings to optimize growing conditions. Today, monitoring and control systems are the standard for modern greenhouses, with continued improvements as the technology advances. Environment conditions can be maintained by these control systems, where the system can be operated manually and/or automatically.

2 .Inexpensive environmental monitoringsystem architecture

Inexpensive Environmental Monitoring system consistsof two basic components (Fig. 3):

- Mobile measuring stations,
- Server-side software.

Many mobile measuring stations, placed on the public transport vehicles (buses, taxi) or private (volunteers) during motion collect data on theconcentration of dust in the air. They used algorithms to optimize energy consumption and make sense of measurement and act as IoT agents.

Measuring stations transfer the data to the server ina situation where they will in the field of public WiFi network (e.g. accessible to the public in buses or other free Hot Spots located in different places of the city).

This solution reduces the operating costs of the system.In addition, the algorithms of transfer the measurement data to the server optimize energy consumption andtransmission time.

On the server side are implemented three basicfeatures:

- Mobile measuring stations (IoT agents) registration,
- Measurement data acquisition,
- Data presentation in various forms, layouts and profiles.

Server-side part of the system uses:

- HTTP server (Apache)
- PHP parser,
- database server (MySQL)
- external services (Google Maps)
- dedicated software (HTML, CSS, JavaScript, PHP).

The software has been developed using the responsive web design (RWD) approach and model-view-controller (MVC) architecture.

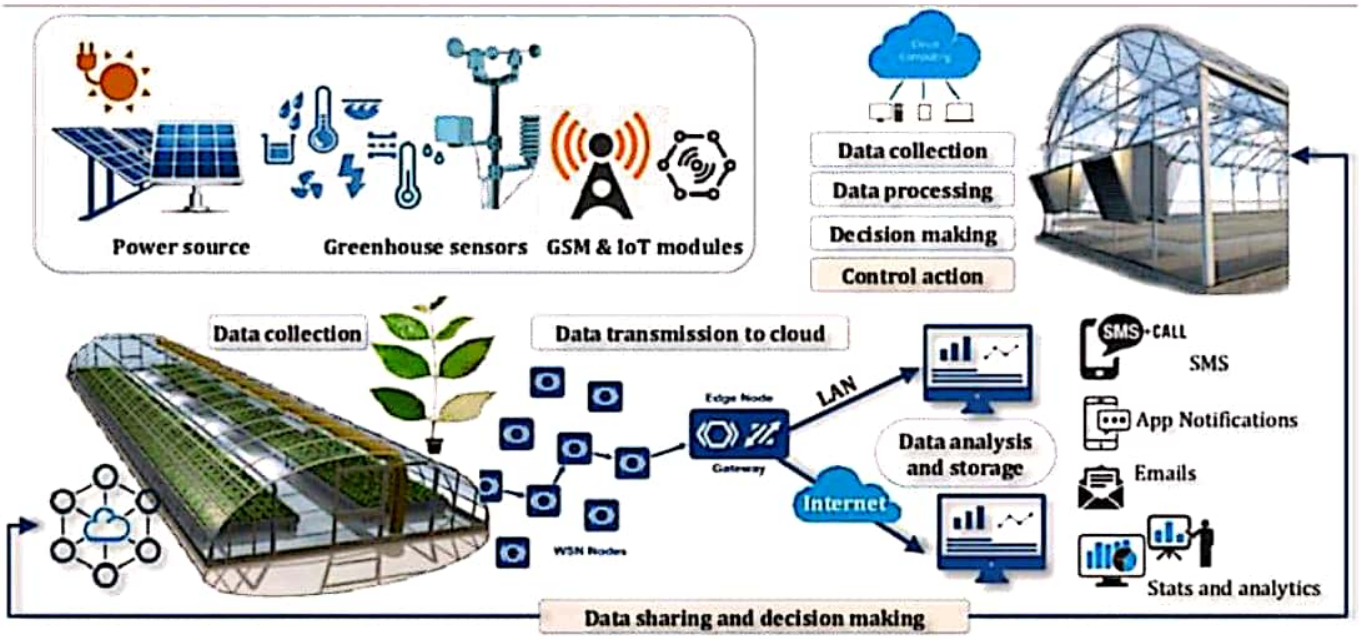
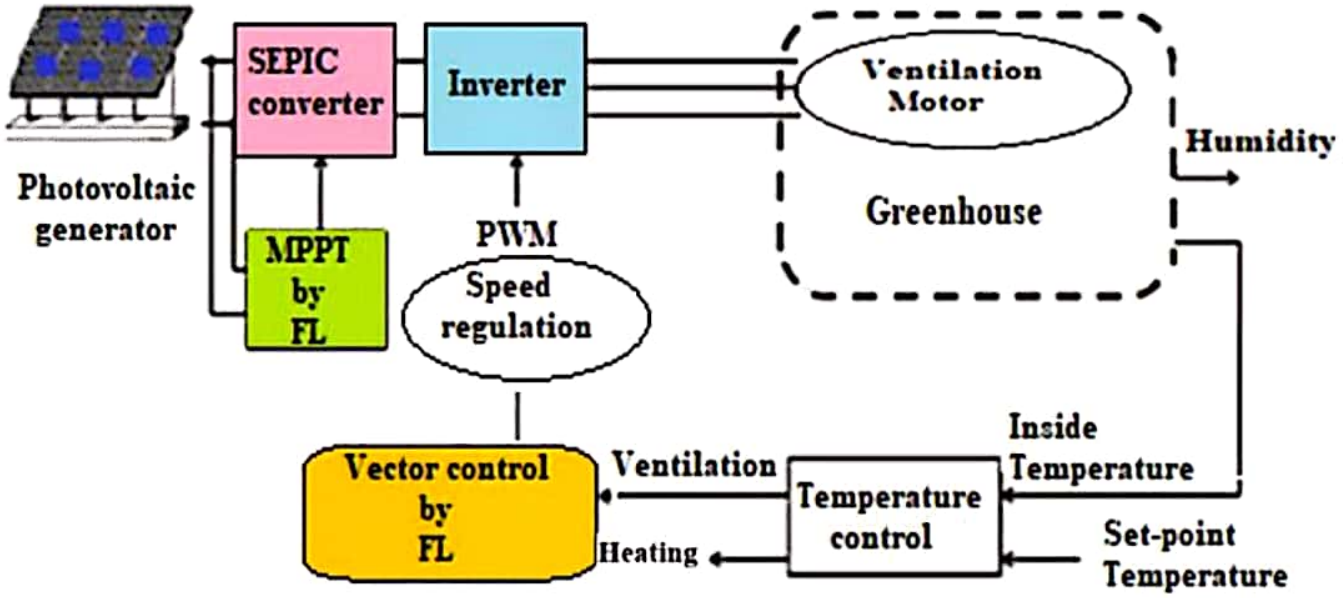


Fig . 3 . Architecture of the Inexpensive Environmental Monitoring System.

3.The moving IoT agent for dustconcentration measurements

The measuring station, which also acts as IoT agent, is designed in the compact way to fulfil the mobility requirements.

The overall architecture of the station is shown in Fig. 4.



Station consists of the few sensors. The main one is the dust sensor for measuring the dust concentration, which gives a good indication of the air quality in an environment. However due to the specific way of dust sensor automatic measurement, this values cannot be assumed as reference values for dust concentration.

The other two sensors are: GPS for determining the position and temperature sensor for acquire working temperature. The range of working temperatures is important due to the dust sensor operation temperatures which are from -10 ℃ to +65 ℃.

The heart of the IoT agent is the Arduino prototyping platform with Atmega chipset onboard. Arduino platform allows for programming all components together and act as single IoT agent. The measurement data is written to SD memory card for later transmission. In the designed system the WiFi module connected to the Arduino board acts as wireless connector. Wiring of the designed measurement station is shown in Fig. 5.

Fig. 5. Wiring of the dust measuring IoT agent.

On the top of Arduino Uno board the GPS shield is set. This shield is also equipped in SD card slot and additionally allows for transparent wire connection of external devices to Arduino board.

All other devices of an IoT agent i.e. dust sensor, temperature sensor and WiFi module are

10000 mAh capacity. That allows for approximately6 hours measurement and communication session.

The hardware parameters of an IoT mobile dust level measuring station are shown in Table 1. Total cost of thestation with additional hardware (cables, resistor, andcasing) is about 125 €.

The agent performs measurements according to flowchart shown in Fig. 6. The series of measured data are averaged (10 measurements of dust level and temperature per second) and the averaged value is written to the file. That was assumed, that with allowed speed limit in the cities in Europe which is 50 km/h the vehicle changes its position by the 13.8 m during one second.

Table 1. Hardware parameters of IoT mobile dustconcentration measuring station.

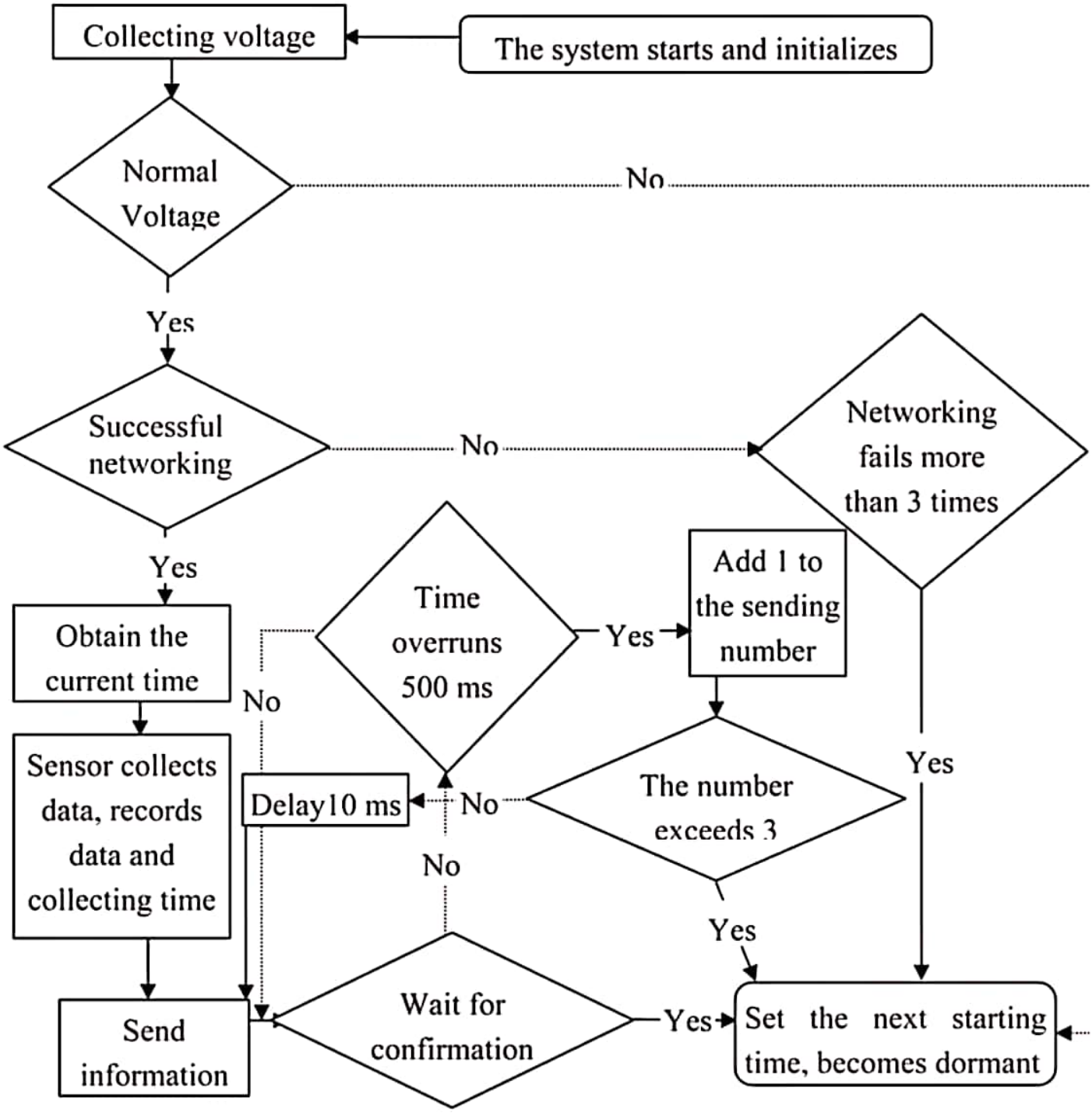
Hardware element	Description
Arduino programmable board	Arduino Uno board which is used as a main platform for sensors and dedicated agent software. Maximum current consumption is 46.5 mA with supplying voltage equals to 5V. Price 25€
Optical Dust Sensor	The sensor GP2Y1010AU0F has a very low current consumption (20mA maximum), supplying voltage up to 7V of direct current. The output of the sensors is an analogue voltage proportional to the measured dust density, with a sensitivity of 0.5V/0.1mg/m3. Price 14€
WiFi module	Wireless ESP8266 module, WiFi 802.11 b/g/n, working frequency 2.4 GHz, PCB antenna, current consumption 140 mA during transmission. Price 3€
GPS and SD card shield	The shield is SparkFun GPS Logger Shield - GPS GP3906-TLP with SD Card slot. It allows for GPS data recording and storing data on SD Card. Current consumption is 30 mA. Price 50€
Power bank	Polymos 10 AIR - 10000mAh power bank. Output current 2.1 A. Price 25€

However according to the [28] average speed varies from 19 to 35 km/h, which translates into a travelled distance from 5.3 to 9.7 meters per one second.

During the movement of the vehicle the IoT agent tries to connect to predefined access points or Hot Spots.Shared by smartphone and other WiFi connection can also be used. It agent succeeds in connecting to Internet, it tries to send to server stored data. The flowchart ofdata sending is shown in Fig. 7. Agent during sending data is working according to FIFO algorithm. The structure of sending to the server data frames is as follow:

Frame := MAC, Number of measurements, {GPS position, DataTime, Type, Measurement;}

Flowchart


Collecting voltage
The system starts and initializes
Normal Voltage
No
Yes
Successful networking
No
Networking fails more than 3 times
Yes
Obtain the current time
Time overruns 500 ms
Yes
Add 1 to the sending number
No
Sensor collects data, records data and collecting time
Delay10 ms
No
The number exceeds 3
Yes
No
Yes
Send information
Wait for confirmation
Yes
Set the next starting time, becomes dormant

Benefits or advantages of Greenhouse Farming:

Following are the benefits or advantages of Greenhouse Farming:

➡It helps in achieving 10 to 12 % higher yield compare to normal farming methods. It depends on greenhouse type, crop type and environment control facilities used.

➡Crop reliability increases using greenhouse farming.

➡It expands growing season for farmers. Hence it is possible to produce floricultural crops throughout the year. It is also possible to produce vegetables and fruit crops during off-season.

➡The major advantage is that it minimizes external threats to the crops under cultivation.

➡It helps in growing different variety of crops.

➡It helps to produce disease free and genetically superior transplants continuously. Efficient utilization of chemicals and pesticides are used to control pest and diseases.

➡It is most useful in monitoring and controlling the instability of various ecological system.

➡Modern techniques of hydroponic, Aeroponics and nutrient film techniques are possible only under greenhouse frames.

Disadvantage of greenhouse farming:

➡It is most useful in monitoring and controlling the instability of various ecological system.

➡Modern techniques of hydroponic, Aeroponics and nutrient film techniques are possible only under greenhouse framing.

Drawbacks or disadvantages of Greenhouse Farming

Following are the drawbacks or disadvantages of Greenhouse Farming:

➡It requires high upfront and operating expenses.

➡It requires careful precautions to eliminate any pest or diseases in order to make sure that consecutive crop production does not get affected.

➡Poor pollination takes place in greenhouse farming.

➡There is lack of awareness among farmers which requires training.

➡It requires regular periodic inspection.

➡Migration birds may be affected due to greenhouse.

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