Designing of Smart Irrigation System Using Arduino

Abhay sharma[1] Lovepreet Singh[2] Harpreet Kaur Channi[3]
[1,2,3]Department of Electrical Engineering
[1,2,3]Chandigarh University, Gharuan, Mohali, India

Abstract— The paper presents a novel approach towards effective irrigation system. Watering the plants and crops is the most important cultural practice and one of the labour intensive tasks in daily greenhouse operation. Watering systems ease the burden of getting water to plants when they need it. Knowing when and how much to water is two important aspects of watering process. This project on "system of automatic irrigation "automated irrigation mechanism which turns the pumping motor ON and OFF on detecting the moisture content of the earth. In the domain of farming, utilization of appropriate means of irrigation is significant. The benefit of employing these techniques is to decrease human interference and still make certain appropriate irrigation. This automated irrigation project brings into play an Arduino board micro-controller, is programmed to collect the input signal of changeable moisture circumstances of the earth via moisture detecting system.

Keywords: Smart Irrigation System, Arduino

I. Introduction

In the fast paced world human beings require everything to be automated. Our life style demands everything to be remote controlled. Apart from few things man has made his life automated. In a production and it is a simple, precise method for country like India, where the economy is mainly based on irrigation. It also helps in time saving, removal of human agriculture and the climatic conditions are isotropic, still error in adjusting available soil moisture levels and to we are not able to make full use of agricultural resources. Maximize their net profits. The main reason is the lack of rains & scarcity of land Irrigation is the artificial application of water to the soil reservoir water. The continuous extraction of water from usually for assisting in growing crops. In crop production earth is reducing the water level due to which lot of land is it is mainly used in dry areas and in periods of rainfall coming slowly in the zones of un-irrigated land. Very important reason of this is due to unplanned use of Types of Irrigation water due to which a significant amount of water goes to surface irrigation waste. It makes the irrigation process more efficient and workers can concentrate on other important farming tasks.

II. Literature review

1) Kriti Taneja et.al (2017) [1] automated irrigation system is developed which is effective enough to optimise utilization of water and other resources. This system helps in irrigation in areas with low water level and leads to sustainability. This system is very volatile and low maintenance and could be adjusted according to various types of crops without much human efforts. Different modules in terms of utility of project that is green house or open field can be developed and implemented using similar techniques. In future this project can be extended to bigger level of agriculture as this project is only limited to farming at home.
2) Mon Arjay F. Malbog et.al (2020) [2] explained that in Irrigation, the issue of wastages of water and farmer can't afford the high price soil moisture sensor was extremely essential to be solved. Therefore, the automatic irrigation system through controlled soil moisture measurement using low-cost sensors becomes important for those who needed the system to aid the problems of farming. The conducted functionality testing and validation to the system resulted in a 100% success rate. This proves and demonstrates that the system is effective and efficient in the issue of soil irrigation. Improvement of the system can be done by adding a water tank to the system, network sensor, monitoring through cloud or IOT, and deep learning.
3) Divyansh Thakura et.al (2019) [3] Explained that by implementing the designed prototype in a greenhouse, the water wastage problem is reduced. Device start automatically irrigating the field when there is need of water. Even though with the help of designed prototype the occurrence of any intrusion the field can be easily identified. In future we will work over soil moisture, pH value of Soil for getting better production of the crops.
4) Emmanuel Abiodun Abioye et.al (2020) [4] Demonstrated that this experimental framework has enhanced precision irrigation leveraging on the IOT platform, which was used for monitoring through the use of different sensors and IOT based weather station.
5) S.R. Barkunan et.al (2020) [5] explained that irrigation control system by sensing the rain fall of an agricultural field is planned to bring out the Indian agricultural activities as an automated one. It can be said from the statistical parameter i.e., standard deviation that the proposed system brings out almost the similar result obtained from the web data in terms of temperature, humidity and rain fall etc.,

III. Methodology

Working of this Automatic Plant Irrigation System is quite simple. First of all, it is a Completely Automated System and there is no need of manpower to control the system. Arduino is used for controlling the whole process and GSM module is used for sending alert messages to user on his cell phone. If moisture is present in soil then there is conduction between the two probes of Soil Moisture sensor and due to this conduction, transistor Q2 remains in triggered/on state and Arduino Pin D7 remains Low. When Arduino reads LOW signal at D7, then it sends SMS to user about "Soil Moisture is Normal. Motor turned OFF" and water pump remains in off state. Now if there is no Moisture in soil then Transistor Q2 becomes off and Pin D7 becomes high. Then Arduino reads the Pin D7 and turns on the water motor and also sends message to user about "Low Soil Moisture detected. Motor turned ON". Motor will automatically turn off when there is sufficient moisture in the soil. This method is based on ultimately profit. , it is the standard with which all other methods are compared. The components used are explained below:

- Arduino Uno
- GSM module
- Transistor BC547 (2)
- Connecting wires
- 16x2 LCD (optional)
- Relay 12v
- Water pump
- Soil Moisture Sensor
- Resistors (1k, 10k)
- Variable Resister (10k, 100k)
- Terminal connector
- Voltage Regulator IC LM317
- Power supply 12v 1A

1) Arduino Uno

Arduino is an open-source platform used for building electronics projects as shown in fig 1.1. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

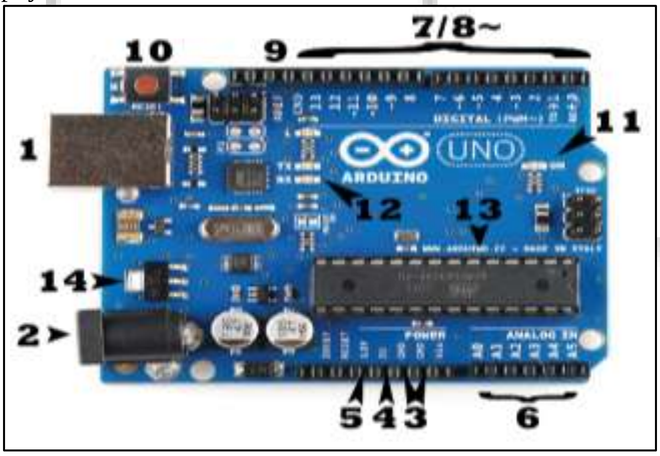

Fig. 1.1:

2) GSM Module:

Here we have used TTL SIM800 GSM module. The SIM800 is a complete Quad-band GSM/GPRS Module which can be embedded easily by customer or hobbyist. SIM900 GSM Module provides an industry-standard interface; the SIM800 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data with low power consumption. The design of this SIM800 GSM Module is slim and compact.as shown in fig. 1.2

Quad - band GSM/GPRS module in small size.

GPRS Enabled

TTL Output

Fig. 1.2:

3) Transistor BC547 (2)

The circuit uses two transistors that work as switches. If the probes do not sense the moisture in the soil, then the resistance between the two probes will increase due to which the transistor Q1 will switch on. If the transistor switches on, it will provide the required voltage at the base terminal of the transistor to make a switch on, then the relay will become activated.

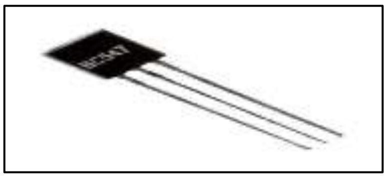

Fig. 1.3:

4) Jumper wires (m/f)

Jumper cables, also known as booster cables or jump leads, are a pair of insulated wires of sufficient capacity with alligator clips at each end to interconnect the disabled equipment/vehicle with an auxiliary source, such as another vehicle or equipment with the same system voltage or to another battery as shown in fig 1.3

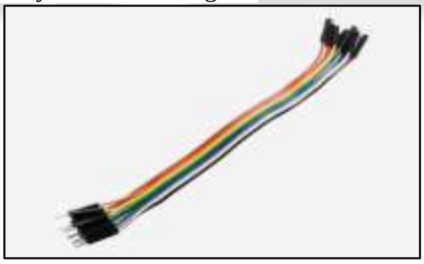

Fig. 1.4:

5) LCD

LCD is used to display messages and status. LCD used in 4bit b mode and driven by Arduino library. As shown in fig 1.5

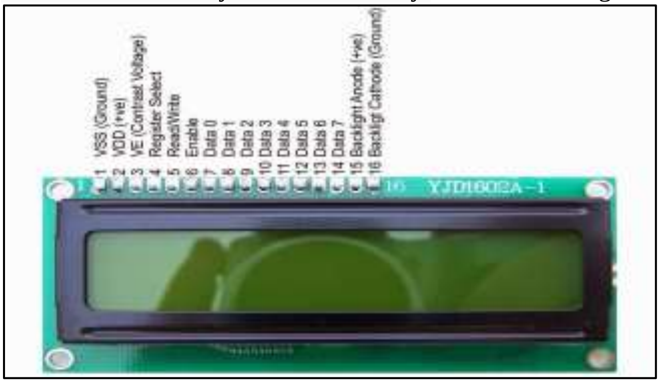

Fig. 1.5:

6) Relay
A 12V Relay is used to control the 220VAC small water pump. The relay is driven by a BC547 Transistor which is further connected to digital pin 11 of Arduino. The relay show in fig.1.6

Fig. 1.6:

7) Water pump
A 12v dc water pump is used to artificially supply water. It can be triggered on and off by sending signals as required as shown in fig 1.7.

Fig. 1.7

8) Soil sensor
Soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons. soil moisture sensor as shown in fig. 1.8.

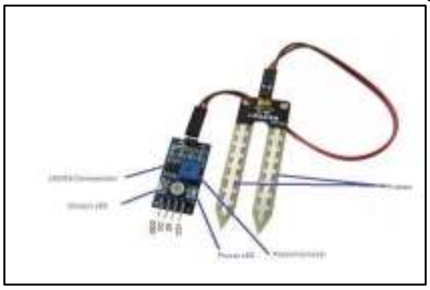

Fig. 1.8:

9) Simulation
As shown in figure 1.9 and 1.10 simulation of this project visible and messege displayed on the LCD. The circuit diagram and Block diagram is shown in figure 1.11 and 1.12.

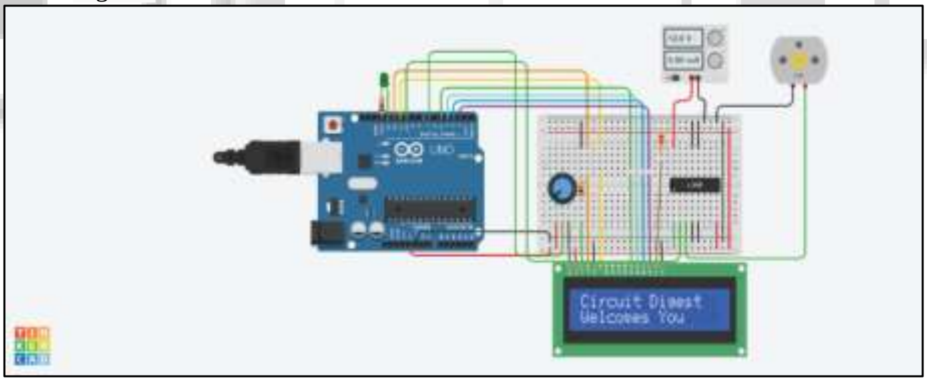

Fig. 1.9:

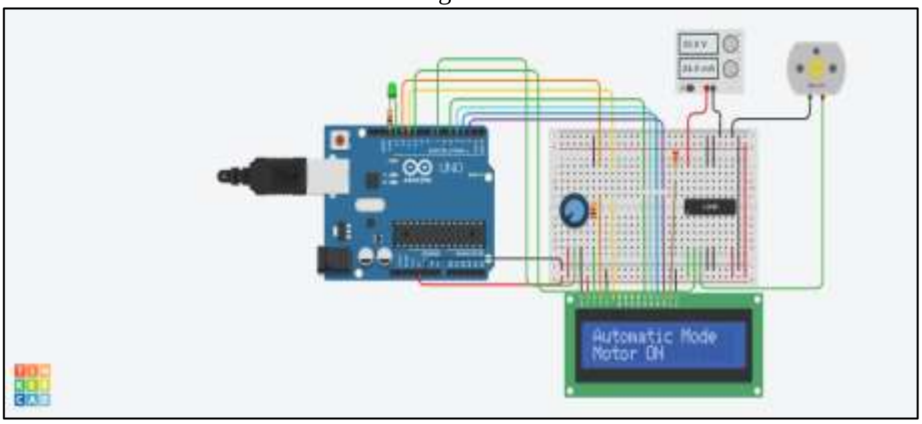

Fig. 1.10:

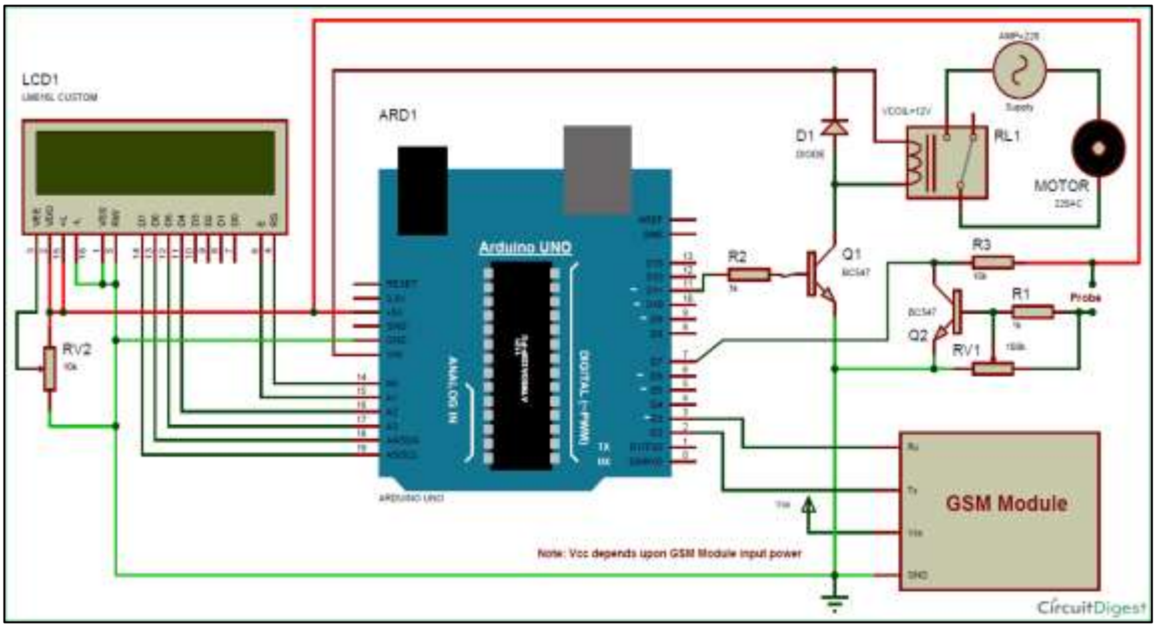

Fig. 1.11:

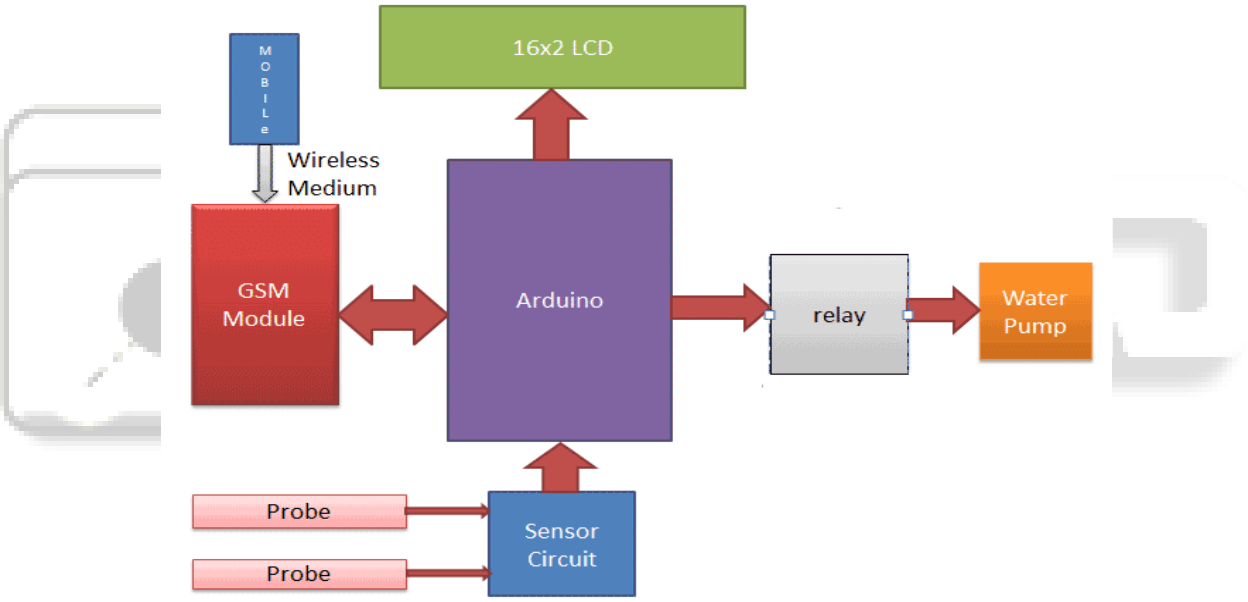

Fig. 1.12

B. Program used in the adruino

```
#include<SoftwareSerial.h>
SoftwareSerial Serial1(2,3);
#include<LiquidCrystal.h>
LiquidCrystal lcd(14,15,16,17,18,19);
int led=13;
int flag=0;
String str="";
#define motor 11
#define sensor 7
void setup()
{
 lcd.begin(16,2);
 Serial1.begin(9600);
 Serial.begin(9600);
 pinMode(led, OUTPUT);
 pinMode(motor, OUTPUT);
 pinMode(sensor, INPUT_PULLUP);
 lcd.print("Water Irrigaton");
 lcd.setCursor(4,1);
 delay(2000);
 lcd.clear();
 lcd.print("Circuit Digest");
 lcd.setCursor(0,1);
 lcd.print("Welcomes You");
 delay(2000);
 gsmInit();
 lcd.clear();
 lcd.print("System Ready");
}
void loop()
{
  lcd.setCursor(0,0);
  lcd.print("Automatic Mode    ");
  if(digitalRead(sensor)==1 && flag==0)
  {
```



```
    delay(1000);
    if(digitalRead(sensor)==1)
    {
      digitalWrite(led, HIGH);
      sendSMS("Low Soil Moisture detected. Motor turned
ON");
      lcd.begin(16,2);
      lcd.setCursor(0,1);
      lcd.print("Motor ON    ");
      digitalWrite(motor, HIGH);
      delay(2000);
      flag=1;
    }
  }
  else if(digitalRead(sensor)==0 && flag==1)
  {
    delay(1000);
    if(digitalRead(sensor)==0)
    {
      digitalWrite(led, LOW);
      sendSMS("Soil Moisture is Normal. Motor turned
OFF");
      digitalWrite(motor, LOW);
      lcd.begin(16,2);
      lcd.print("Motor OFF");
      lcd.setCursor(0,1);
      lcd.print("Motor OFF");
      delay(2000);
      flag=0;
    }
  }
}

void sendSMS(String msg)
{
  lcd.clear();
  lcd.print("Sending SMS");
  Serial1.println("AT+CMGF=1");
  delay(500);
  Serial1.print("AT+CMGS=");
  Serial1.print("");
  Serial1.print("+919610126059");    // number
  Serial1.print("");
  Serial1.println();
  delay(500);
  Serial1.println(msg);
  delay(500);
  Serial1.write(26);
  delay(1000);
  lcd.clear();
  lcd.print("SMS Sent");
  delay(1000);
  lcd.begin(16,2);
}
void gsmInit()
{
  lcd.clear();
  lcd.print("Finding Module..");
  boolean at_flag=1;
  while(at_flag)
  {
    Serial1.println("AT");
    while(Serial1.available()>0)
    {
      if(Serial1.find("OK"))
      at_flag=0;
    }
    delay(1000);
  }
  Serial1.println("ATE0");
  lcd.clear();
  lcd.print("Finding Network..");
  boolean net_flag=1;
  while(net_flag)
  {
    Serial1.println("AT+CPIN?");
    while(Serial1.available()>0)
    {
      if(Serial1.find("READY"))
      net_flag=0;
      break;
    }
    delay(1000);
  }
  Serial1.println("AT+CNMI=2,2,0,0,0");
  delay(1000);
  Serial1.println("AT+CMGF=1");
  delay(1000);
  Serial1.println("AT+CSMP=17,167,0,0");
  lcd.clear();
  Serial1.flush();
}
```

IV. RESULT AND DISCUSSION

Irrigation becomes easy, accurate and practical with the same soil sample impossible. Because of the idea above shared and can be implemented in agricultural difficulties of accurately measuring dry soil and water fields in future to promote agriculture to next level. The Volumes, volumetric water contents are not usually output from moisture sensor and level system plays major determined directly. Role in producing the output.

V. CONCLUSION AND FUTURE SCOPE

The primary applications for this project are for farmers and gardeners who do not have enough time to water their Crops/plants. It also covers those farmers who are wasteful of water during irrigation. The project can be extended to greenhouses where manual supervision is far and few in between. The principle can be extended to create fully automated gardens and farmlands. Combined with the principle of rain water harvesting, it could lead to huge water savings if applied in the right manner. In agricultural lands with severe shortage of rainfall, this model can be successfully applied to achieve great results with most types of soil.

References

[1] https://www.un. org/development/desa/en/news/population/world-population-prospects2020
[2] https://ourworldindata. org/world-population-growth
[3] https://www.un.org/development/desa/en/news/population/2020-revision-of-worldurbanization-prospects.html
[4] X. Zhang and E. A. Davidson, ''Improving nitrogen and water management in crop production on a national scale,'' in Proc. AGU Fall Meeting Abstr., Dec. 2018.
[5] https://www.fao.org/wsfs/forum2050/wsfs-forum/en/
[6] A. D. Tripathi, R. Mishra, K. K. Maurya, R. B. Singh, and D. W. Wilson, ''Estimates for world population and global food availability for global health,'' The Role of Functional Food Security in Global Health. 2019, pp. 3–24. [8] M. Elder and S. Hayashi, ''A regional perspective on biofuels in Asia,'' in Biofuels and Sustainability (Science for Sustainable Societies). Springer, 2018.
[7] World Agriculture: Towards 2015/2030 by FAO.Available: https://www.fao.org/3/a-y4252e.pdf
[8] L. Zhang, I. K. Dabipi, and W. L. Brown, ''Internet of Things applications for agriculture,'' in Internet of Things A to Z: Technologies and Applications, Q. Hassan, Ed., 2018.
[9] S. Navulur and M. N. Giri Prasad, ''Agricultural management through wireless sensors and Internet of Things,'' Int. J. Elect. Comput. Eng., vol. 7, no. 6, pp. 3492–3499, 2017.
[10] E. Sisinni, A. Saifullah, S. Han, U. Jennehag, and M. Gidlund, ''Industrial Internet of Things: Challenges, opportunities, and directions,'' IEEE Trans. Ind. Informat., vol. 14, no. 11, pp. 4724–4734, Nov. 2018.
[11] M. Ayaz, M. Ammad-Uddin, I. Baig, and E.-H. M. Aggoune, ''Wireless sensor's civil applications, prototypes, and future integration possibilities: A review,'' IEEE Sensors J., vol. 18, no. 1, pp. 4–30, Jan. 2018
[12] J. Lin, W. Yu, N. Zhang, X. Yang, H. Zhang, and W. Zhao, ''A survey on Internet of things: Architecture, enabling technologies, security and privacy, and applications,'' IEEE Internet Things J., vol. 4, no. 5,pp. 1125–1142, Oct. 2017.
[13] X. Hi, X. An, Q. Zhao, H. Liu, L. Xia, X. Sun, and Y. Guo, ''State-of-theart Internet of Things in protected agriculture,'' Sensors, vol. 19, no. 8, p. 1833, 2019.
[14] O. Elijah, T. A. Rahman, I. Orikumhi, C. Y. Leow, and M. N. Hindia,''An overview of Internet of Things (IoT) and data analytics in agriculture: Benefits and challenges,'' IEEE Internet Things J., vol. 5, no. 5,pp. 3758–3773, Oct. 2018.
[15] Code of Conduct on Agricultural Data Sharing Signing. https://www.ecpa.eu/news/code-conduct-agricultural-data-sharing-signing.
[16] Industry 4.0 in Agriculture: Focus on IoT Aspects.Available: https://ec.europa.eu/growth/tools-databases/dem/monitor/content/industry-40-agriculture-focus-iot-aspects.
[17] K. Thea, C. Martin, M. Jeffrey, E. Gerhard, Z. Dimitrios, M. Edward, and P. Jeremy, ''Food safety for food security: Relationship between global megatrends and developments in food safety,'' Trends Food Sci. Technol.,vol. 68, pp. 160–175, Oct. 2017.

