Automatic Farm Irrigation System using GSM Techniques

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Abstract— Economy of India is mostly contributed by Agriculture which is the source of most of the Indian people. Irrigation is defined as the science of artificial application of water to the farm that means depending on the soil type, plant are to be provided with water. This system sets the irrigation time depending on the water level of tank and moisture reading from the sensors and can automatically irrigate the field. Also the pesticides are automatically spread on the crop depending on conditions which are given in the program. The main aim of this project is to design Automated Farm Irrigation System using a Sensor and GSM Technique. The controller informs farmer about many conditions like water level in the tank, moisture content in soil, pesticides control via SMS on GSM network.
Key words: PLC, GSM, Automation System, Real time monitoring, TwinCAT3

I. INTRODUCTION

For continuously increasing demand of food necessities, it's important to rapid improvement in production of food technology. One of the source which provide this is Agriculture. Agriculture plays the very important role in the economy as well as in development. Due to lack of water and scarcity of land water results in decreasing volume of water on earth, so the Farmer use irrigation. Irrigation may be defined as the science of artificial application of water to the land or soil that means depending on the soil type, plant are to be provided with water. An automated irrigation system was developed to optimize water use for agricultural crops[1]. Nowadays for irrigation different Techniques are available which is used to reduce the dependency of rain and mostly this technique is driven by electrical power and on/off scheduling controlled [4]. Automated irrigation system consists of a feedback control system that employs monitoring of environmental parameters and controlling irrigation. Environmental parameter such as soil moisture and humidity plays an important role in overall development of the crop and good yield. Conservation of water and other resource can be achieved by optimizing these parameters. In this project we are going to implement automatic farm irrigation system using GSM technique. In that we will check amount of water the tank and according to that message will send to farmer through GSM. Then farmer will decide either to turn the motor ON/OFF. Also soil moisture sensor will check the moisture content in the soil and moisture reading will send to the farmer. If reading is greater than reference value then valve will turn ON otherwise Valve remains OFF. For spreading the pesticides in the farm controller will send message to farmer, according to that farmer will give response about spreading of pesticides. For security purpose of farm we are using sensors which will sense the person/outsider that is if any animal or person come inside the farm then alarm will turn ON.

II. SYSTEM ARCHITECTURE

A. Description of Block Diagram

Power supply of 24v DC given to PLC. Sensors will sense the field signals and convert it into low level signals. With the help of software program will fed into the controller. Then controller will perform the appropriate operation on the signals. The output of controller is given to output field devices. Here GSM module is used to send and receive message to/from farmer through PLC. Actuators are used to convert the output signal into actual motion. Alarm is use for farm security.
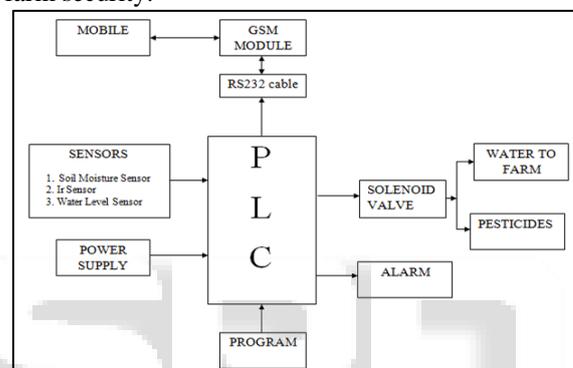

Fig. 2.1: Automatic Farm Irrigation System

B. Hardware Design

1) PLC module

- The CX9020 is a compact, DIN rail-mountable Ethernet control system with 1 GHz ARM Cortex™-A8 CPU.
- The connection for the Beckhoff I/O systems is directly integrated into the CPU module. The unit offers automatic bus system identification (K-bus or E-bus) and independently switches in the corresponding mode.
- The CX9020 comprises the CPU with two microSD card slots, the internal RAM and 128kB NOVRAM as non-volatile memory
- TwinCAT automation software transforms a CX9020 system into a powerful PLC and Motion Control system that can be operated with or without visualisation.
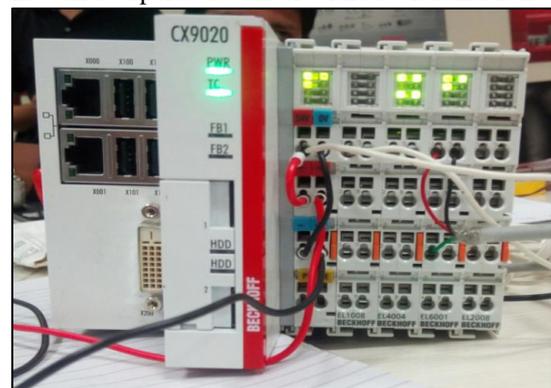

Fig. 2.2: PLC module

2) *Sensors*

a)   ANALOG soil moisture sensor

− The Soil Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium.

− In soil, dielectric permittivity is a function of the water content. The sensor creates a voltage proportional to the dielectric permittivity, and therefore the water content of the soil.

− Measuring soil moisture is important for agricultural applications to help farmers manage their irrigation systems more efficiently.

− Knowing the exact soil moisture conditions on their fields, not only are farmers able to generally use less water to grow a crop, they are also able to increase yields and the quality of the crop by improved management of soil moisture during critical plant growth stages.

b)   IR sensor

− An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation.

− Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion.

− Infrared waves are not visible to the human eye. In the electromagnetic spectrum, infrared radiation can be found between the visible and microwave regions. The infrared waves typically have wavelengths between 0.75 and 1000µm.

c)   Infrared Sensor Working

− Photo diode emits IR radiations when it strikes to any object, then turn back with some angle. The IR receiver detects reflected radiations.
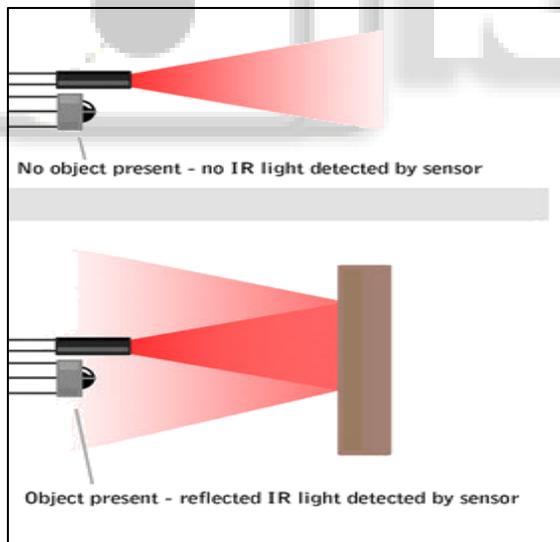

Fig. 2.3: Infrared Sensor Working

d)   Water level sensor

− The purpose of a water level sensor is to open or close a circuit as the level of a liquid rises or falls.

− Most float switches are "normally closed," meaning the two wires coming from the top of the switch complete a circuit when the float is at its low point, resting on its bottom clip
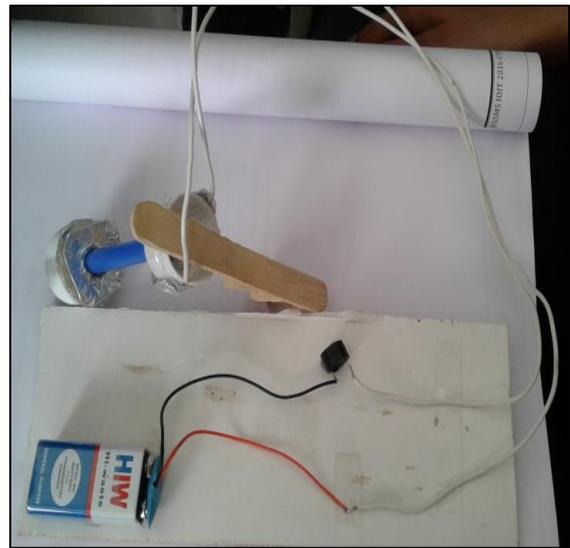

Fig. 2.4: Water Level Sensor

3) *PC interface*

4) *Solenoid valve*

An electric current through the coil creates a magnetic field. The magnetic field exerts a force on the plunger. As a result, the plunger is pulled toward the centre of the coil so that the orifice opens. This is the basic principle that is used to open and close solenoid valves.
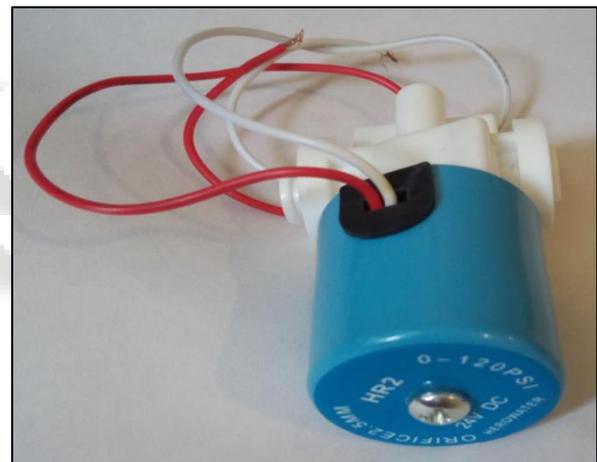

Fig. 2.5: Solenoid Valve

5) *GSM module*

− The GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number.

− Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily. The modem can either be connected to PC serial port directly or to any microcontroller or PLC.

− It can be used to send and receive SMS or make/receive voice calls.

Fig. 2.6: GSM module

6) *Mobile Phone*
- Mobile is used to communicate with the GSM module. It is use for sending and receiving the message to/from GSM
- A mobile phone may also be known as a cellular phone or simply cellphone.
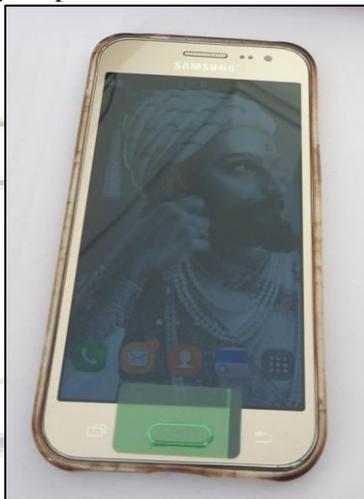

Fig. 2.7: Mobile

7) *Submersible pump*
- A submersible pump is a device which has a hermetically sealed motor close-coupled to the pump body.
- Submersible pumps push fluid to the surface as opposed to jet pumps having to pull fluids.
- Submersibles are more efficient than jet pumps.

Fig. 2.8: Submersible Pump

8) *RS232 cable*
9) *EtherCAT module-EL6001*
- The device connected to the EL6001 EtherCAT Terminal communicates with the automation device via the coupler.
- The active communication channel operates independently of the higher-level bus system in full duplex mode at up to 115.2kbaud.
- The RS232 interface guarantees high immunity to interference through electrically isolated signals.
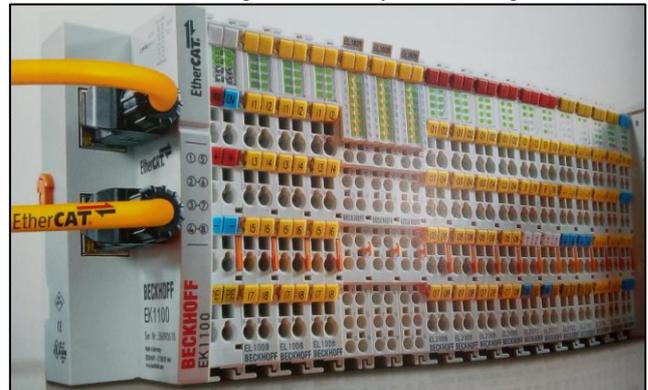

Fig. 2.9: EtherCAT module-EL6001

C. *Software Design*

1) *TwinCAT 3 / eXtended Automation (XA)*
- Beckhoff created a global standard for automation with the launch of PC-based control technology in 1986.
- On the software side, the TwinCAT (The Windows Control and Automation Technology) automation suite forms the core of the control system.
- The TwinCAT software system turns almost any PC-based system into a real-time control with multiple PLC, NC, CNC and/or robotics runtime systems.
- TwinCAT 3 is the systematic further development of TwinCAT 2, with which the world of automation technology is being redefined.

2) *TwinCAT 3 highlights*
- only one software for programming and configuration
- Visual Studio integration
- more freedom in selecting programming languages
- use of C/C++ as the programming language for real time applications
- open interfaces for expandability and adaptation to the tools landscape
- flexible runtime environment
- active support of multi-core and 64-bit systems
- migration of TwinCAT 2 projects
- automatic code generation and project implementation with the TwinCAT Automation Interface
- extended real-time-functionality: min. 50 cycle time and low jitter

Fig. 2.9: TwinCAT 3

3) MICROSOFT VISUAL STUDIO 2010

- Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft.
- It is used to develop computer programs for Microsoft Windows, as well as web sites, web apps, web services and mobile apps.
- Visual Studio is a free, fully-featured, and extensible IDE for creating modern applications for Windows, Android, and iOS, as well as web applications and cloud services.
- Visual Studio Express is a set of freeware integrated development environments (IDE) developed by Microsoft.
- Visual Studio Code is a cross-platform web and cloud development code editor available not just for Windows, but for Mac and Linux, too.
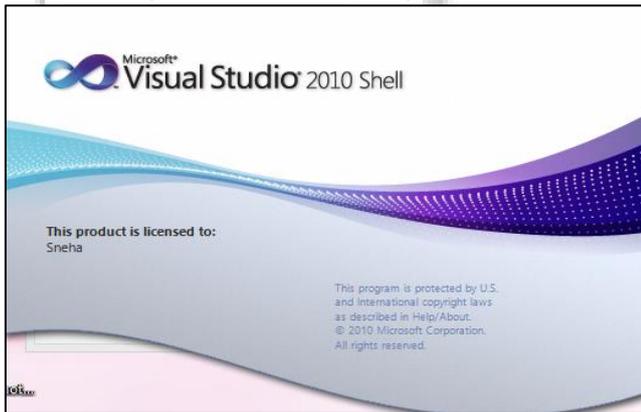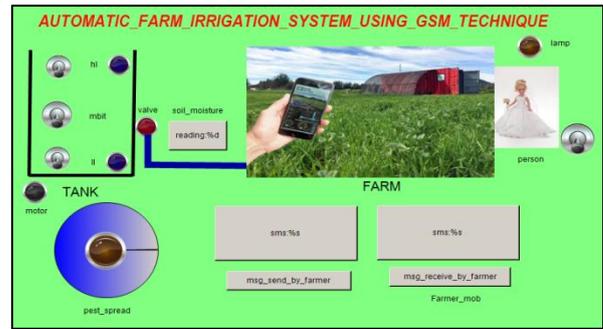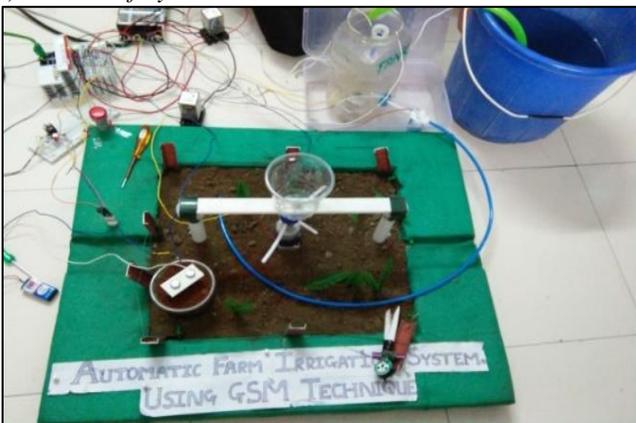

Fig. 2.10: Microsoft Visual Studio 2010

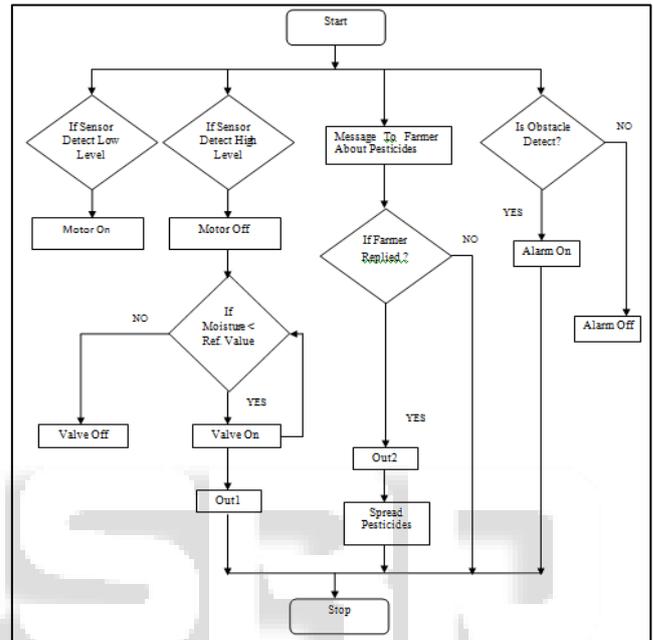### 4) Photos of System

III. FLOW CHART

Fig. 2.11: Flowchart

IV. RESULT

- The automatic irrigation system using wireless technology should provide efficient system capable of conserving resources and human effort.
- The system also facilitates real-time remote monitoring of the current environmental condition of field.

V. CONCLUSION

- We can conclude that interfacing of GSM with PLC is done successfully and thus can use it for agriculture processes which are based on PLC.
- It saves water, energy and efforts of farmer.
- Real rime monitoring using PLC on a PC or laptop.
- System is responsible for efficient utilization of water resource and man power.

VI. FUTURE SCOPE

- The system has advantage of using Bluetooth if the user is within the 10m range of designed system. The use of Bluetooth technology cuts down the cost of SMS if the user is within the limited range of designed system.
- In future we can spread the pesticides with the help of robotic arm.

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