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Preparation GSM Controlled Home Automation System

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ABSTRACT
Global mobile communication system known as the Global System for Mobile Communications, or GSM briefly on a mobile phone communications protocol. Today, this protocol is used as much as communication between machines, from communication between people. The spread of mobile phones in particular, and their economical availability, enable mobile phones to be used in automation systems other than video and audio speaking. A home automation system was designed and controlled by mobile phone over GSM. Beside lighting, socket, fan and door control in prepared home automation system, fire, heat and humidity measurements are made instantaneously. All these controls can be provided remotely with mobile device. When the designed automation system is examined, it is an example to work with GSM based remote control automation systems in all aspects.
Keywords: Arduino, GSM Control, Home Automation, Remote Control

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I. INTRODUCTION

Along with the developing technology, it is known that home automation systems are spreading from past to present day [1]. The concept of smart home in home automation systems was also first used by the American Housewives Association in 1984. However, the history of home automation is based on a longer history. Wired homes, the first premises of smart homes, have begun to be developed by enthusiasts since the early 1960s [2]. Different day-to-day work has used different terms such as home automation, intelligent building, building automation system, intelligent building and integrated home systems instead of smart house.

Developments in communication technologies that are progressing depending on the development of technology have also contributed to the development of home automation systems. Especially nowadays mobile phones enable communication technologies to enter into our pocket. Mobile phones provide many services besides communication technologies. For this reason, it has become a part of our life.

The development of technology is not only limited to the ones mentioned above, but also makes electronic devices used in homes smarter. Some of the electronic equipment used have their own electronic circuitry. Nearly every electronic device has its own microprocessor or microcontroller. Such systems are called "Embedded Systems". Embedded systems generally refer to the entirety of electronic hardware and software contained within any system that gives "intelligence" to that system [3].

When the studies are examined, there are only microcontroller based applications specially designed for home automation. Bayer et al. have conducted a microcontroller-based application using a variety of detectors (motion, door / window, gas, smoke, temperature, etc.) on a model house model [4].

Yıldız and Karaboğa have provided wireless communication with each other in home automation systems. They have developed special hardware with a microcontroller base in their developed application [5].

GSM-based work in the home automation system with remote control is quite advanced [6]. Low-cost systems have been developed for real-time monitoring and control of a house [7]. At the same time, the use of GSM was preferred in home security systems as well as remote home control [8].

In the prepared project, automation system software was developed especially on Arduino IDE which is an open source software development tool. Arduino Mega, a general purpose microcontroller card, was chosen. This allows the system to be simple and understandable for everyone to understand. In the study a home model is also prepared, where various sensors are used together at Mehmet Akif Ersoy University, in the Mechatronics Program of Technical Sciences Vocational School.

On this model, a home control system has been prepared for the most needed automation systems and their control is provided by remote mobile communication. One of the purposes of the

project is to demonstrate how remote control can be done to students through this automation application.

The study consists of 3 stages. On the first stage, a house model with various perceptors was prepared. Second stage circuit connections have been performed. With the general purpose Arduino card used in the system, all the current states of the sensors have been checked. At this stage, Arduino forms the brain of the system. In addition, a circuit design has been made to provide the necessary equipment connection and to eliminate cable clutter. In the third stage, control is provided by mobile phone. At this stage, Arduino was added to the GSM card and the system was controlled via the mobile phone.

II. SYSTEM STRUCTURE

As mentioned in the introduction, the system was implemented in three stages. These consist of model design, circuit connections and finally mobile phone control.

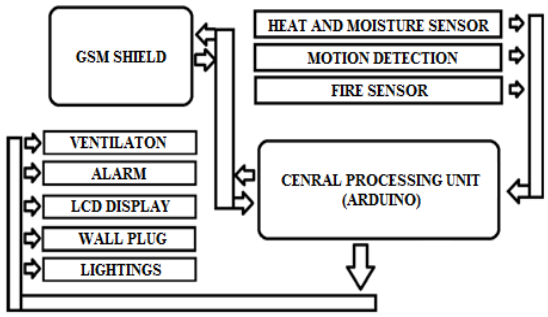

Figure 1. General scheme

The general structure of the system is shown in Fig. 1 Data from heat, humidity, motion, fire sensors are processed on Arduino, the central processing unit. The data processed in the Arduino is transferred either wired or wireless to provide control of the required outputs. Bidirectional data transmission with GSM module in the system are provided.

2.1 MODEL DESIGN

At the first stage of the project, a sample house model is designed. The designed model consists of two rooms, a living room, a kitchen, a kitchen counter, an outside door and a balcony. The prepared model is designed as a suitable design for different scenarios. The top view of the prepared model is shown in Fig. 2.

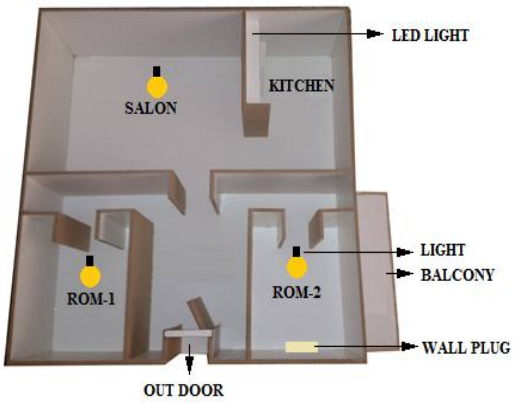

Figure 2. Top view of the prepared model

2.2. CIRCUIT CONNECTIONS

After the model design, the sensors were installed in the appropriate places. DHT11, HCSR501 and UVFlame (760nm-1100nm) sensors were used in the system. DHT11 is used for temperature and humidity measurement, HCSR501 is used for motion detection and UVFlame is used to detect fire. The sensors used are also shown in Fig. 3.

Figure 3. HCSR501, DHT11 and UVFlame (760nm-1100nm) Sensors

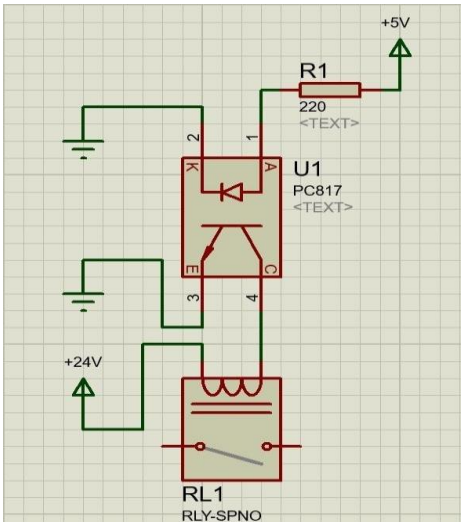

Figure 4. Control circuit

The project also includes lighting with AC 220V and socket control to make the current life safer. The control circuit in Fig. 4 is prepared so that these controls can be performed. The PC817 optocoupler shown in the circuit in Fig. 4 can control the power from 35V to 50mA. In this way, the maximum 250V - 5A can be controlled with the

relays used in the system. The output contact of the relay used is normally an open contact.

In the circuit shown in Fig. 4, independent control of two different power supplies is provided. Thus, since there is no direct connection between the two sources, the entire system is prevented from being damaged due to the electrical problem that may occur in the system.

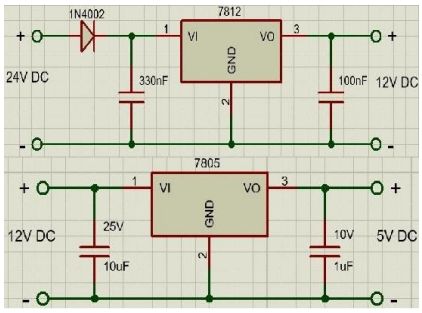

Figure 5. Voltage reducer

A complex cabling situation has arisen due to the use of eight roles, dc motor, three different sensors, lcd, led and GSM modüle in this system. For this reason, a circuit design has been prepared to minimize the wiring.

Since the components in the system are operating at different voltage values, a voltage reducer is added on this circuit as shown in Fig. 5. This voltage reducer has two different outputs, 5V and 12V. The 7812 and 7805 integrations are used on the added voltage reducer.

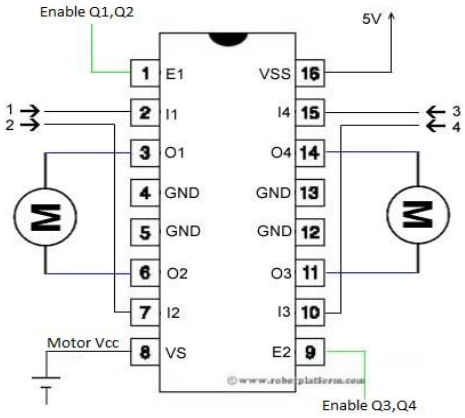

Figure 6. Control Circuit

L293D integration is used to drive the engines used for ventilation and doors in the system. The connection diagram of the integrator used is shown in Fig. 6.

Figure 7. 2x16 lcd

There is a 2x16 LCD in the system as shown in Fig. 7. This LCD shows messages received via GSM and the data coming from the sensors.

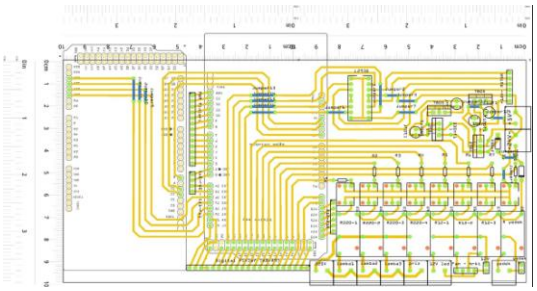

Figure 8. Additional circuit design

Fig. 8 shows the circuit of the card designed to remove the cable clutter and ease of montage in the system.

Figure 9. Top view of the designed automation system

The outputs used in the system shown in Fig. 9 are provided by relays placed on the circuit. Since the designed automation system is planned to be flexible, there are two more relay outputs on the system.

III. CONTROL WITH MOBILE PHONE

One GSM card was used in the system to communicate with the mobile phone. The circuit connection of the used card to the arduino is shown in Fig. 10. The RX1, TX1, RX2, TX2 pins on the board are connected to the RX1, TX1, RX2, TX2 pins on the arduino.

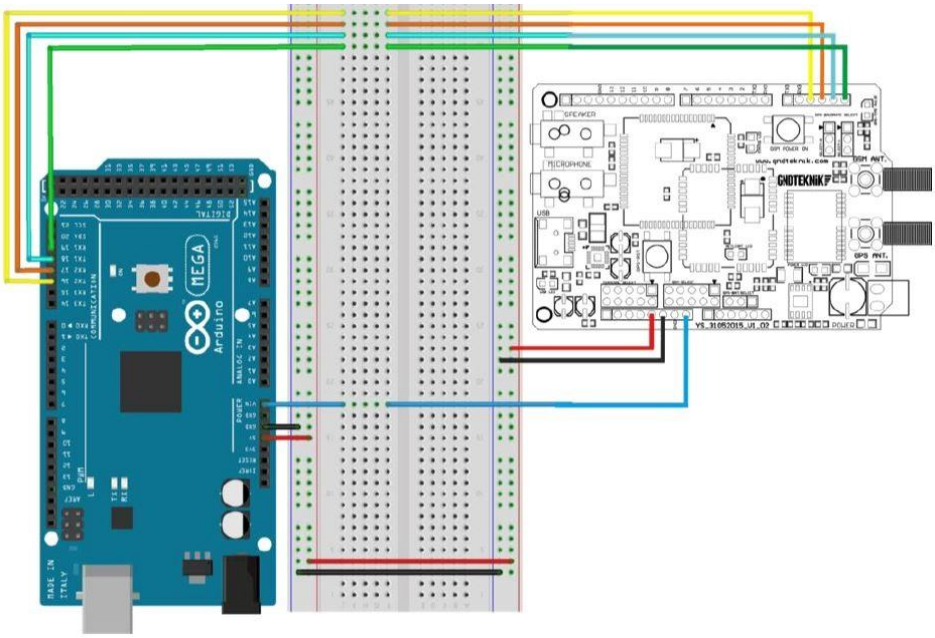

Figure 10. GSM card connection with arduino

With the designed system, the Arduino GSM card can be used to receive information about the current state of the sensors in the house at a desired time. For example; the instantaneous temperature and humidity sensor (DHT11), the fire sensor, the motion sensor (HCSR501) are sent to the mobile phone via the message when the "information_send" message is sent to the prepared system. Apart from this, if only the heat information is requested, the heat information of the system with the message "information_power" sent to the system comes through the message to the mobile phone.

In addition, if the person wants to intervene in the system from the outside. For example, it can turn the house door or lights on and off, and can directly turn off the energy of any prize-connected device in the house or the whole house.

The designed system can be programmed in the direction of the sample scenario written in Arduino. For example, in the prepared system, motion detectors located in the house detect the movement during the theft, the speaker for the alarm is activated and the message is sent to the phone number specified in the system.

In the event of a fire, a fire is detected by the fire sensor and data is sent to the phone numbers defined in the program via the message. In the same way, the fan connected to the system automatically switches on when the inside temperature is above the specified values, and the user is informed via message.

IV. CONCLUSION

With the designed system, a basic home automation control over GSM is provided. Especially with the system prepared in the rural areas where the internet is not available, many controls can be provided by GSM access.

The system is developable due to its open source code design. Various sensors can be added and used in different applications. For example, it has a wide range of usage from greenhouse control to remote water pump control.

In addition, it is a practical example of how a technical student can control a home automation. It is seen that this study can be produced at reasonable costs with the widespread use of microcontroller and embedded system and can contribute to different remote control areas.

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