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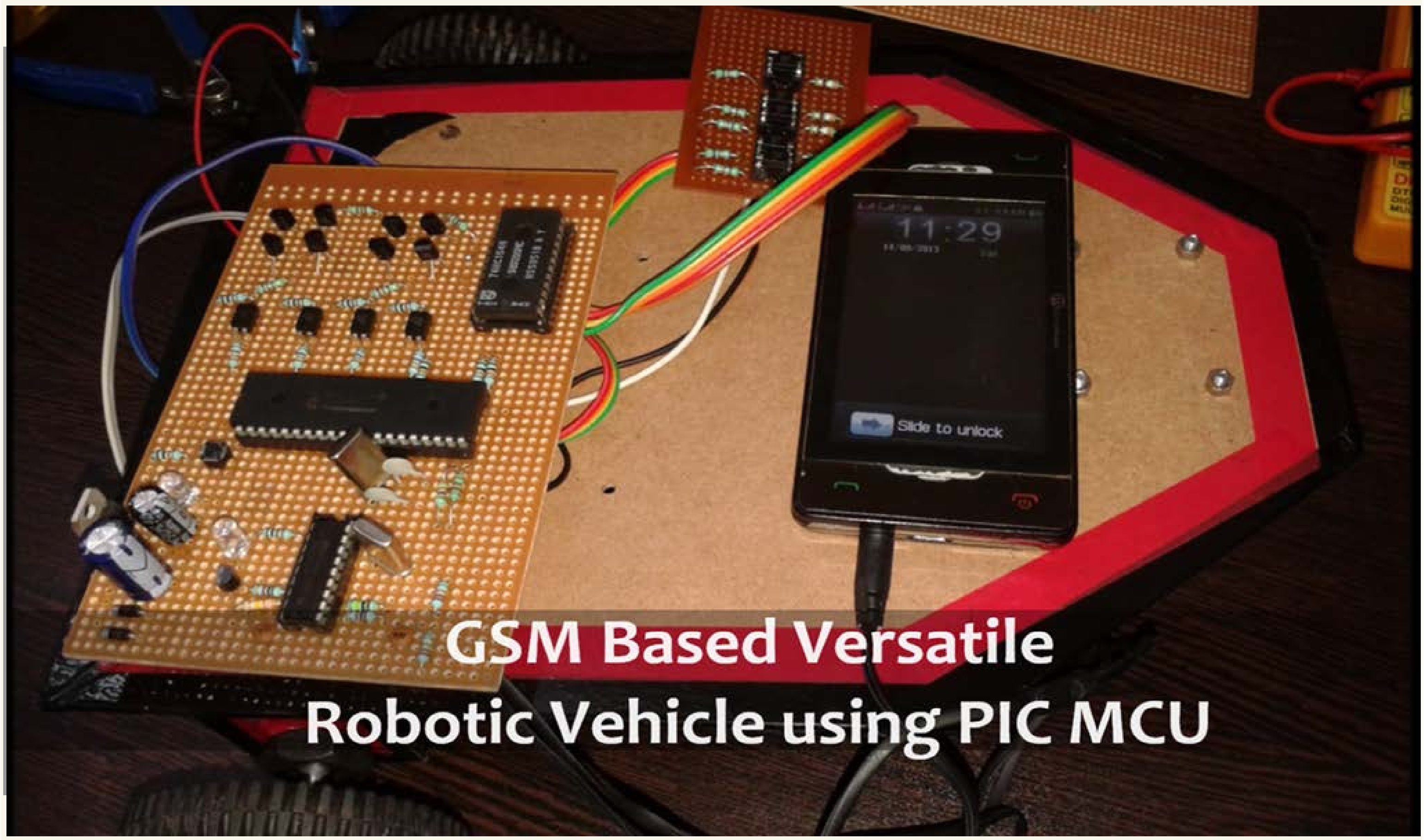
GSM Based Versatile Robotic Vehicle



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GSM BASED VERSATILE ROBOTIC VEHICLE

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Chapter 1

Introduction To Robotics

The word ‘Robot’ is one of those elusive terms that have defied unique definition. One reason for this is that its use changes all the time. Initially, a robot was a humanoid or human-like being. The word ‘Robot’ was derived from the Czech word meaning ‘slave labor’ and was coined by Kapec in his play, Rossum’s Universal Robots in 1921. These robots were biochemical – what we would now call androids. This was followed soon after by a number of films featuring robots such as Fritz Lange’s 1922 Metropolis that excited the imagination of both the public and the science and engineering communities. Science fiction books such as Asimov’s ‘I Robot’, from where we got the term robotics, were also popular at this time. These robots were easy to define as non-living machines that looked and acted like humans. In the real world of industry and academia, however, robots were not anything like humanoids. In the academic world, the most advanced robot in the 1970s was the Stanford Cart which had a body made up of what looked like a shallow rectangular box on wheels from an old fashioned baby carriage (pram). In those days the idea was to go for human modes of reasoning, rather than human shapes. Unfortunately, because of the complexity of the models of human, perception-inference-reasoning, this type of robot would move about one meter every 15 minutes. So the 1980s saw a shift towards robot controllers being modeled on insects and other animals and this enabled the sort of fast reactive responses that you can see in modern day toy sensing robots and robot pets. The major uses in industry, e.g. painting cars, required only robot arms rather than whole robots. Initially these were considered to be ‘part of’ a robot’s body but they eventually became known as robots in their own right. The major distinction is now between *non-mobile robots* such as arms and actuators and mobile robots, which may be wheeled, legged or may even be propelled through water or air. Another important distinction is between autonomous and non autonomous robots. Originally, robots would only be considered to be a robot if it was autonomous. That is, they could operate on their own without human intervention. It is now perfectly acceptable to call any autonomous vehicle a mobile robot even if it looks like a car, a plane or a horse. It is also becoming increasingly acceptable to use the term robot for remote controlled vehicles. This started off with tele-robotics, robots operated at a distance, like those used by emergency services for bomb disposal and firefighting. Then came the remote controlled robot used in television contests like *Robot Wars*, *TechnoGames* and *Mechanoids*.

The 3 Laws of Robotics

Books, movies, stories, and other works of fiction help us think about the real world in new ways. Science fiction has often been inspired by the future possibilities of robotics. However, the relationship betweens science fiction and robotics is a two way street: science fiction affects the field of robotics as well. Early in the history of robots, acclaimed writer Isaac Asimov became concerned that humanity was unprepared for what he saw as the inevitable: robots becoming an integral part of society in the future. In 1942, he created a 3-point code of conduct for the 21st century robots written about in his many books. We call these **Asimov's Laws of Robotics**:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders conflict with the first law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second law.

Basic Parts of a Robot Vehicle:

Basically a robot consists of the following basic, yet important parts –

- A mechanical device, such as a wheeled platform, arm, or other construction, capable of interacting with its environment.
- Sensors on or around the device those are able to sense the environment and give useful feedback to the device.
- Systems that process sensory input in the context of the device's current situation and instruct the device to perform actions in response to the situation.

In the manufacturing field, robot development has focused on engineering robotic arms that perform manufacturing processes. In the space industry, robotics focuses on highly specialized, one-of-kind planetary rovers. Unlike a highly automated manufacturing plant, a planetary rover operating on the dark side of the moon - without radio communication - might run into unexpected situations. At a minimum, a planetary rover must have some source of sensory input, some way of interpreting that input, and a way of modifying its actions to respond to a changing world. Furthermore, the need to sense and adapt to a partially unknown environment requires intelligence (in other words, artificial intelligence). From military technology and space exploration to the health industry and commerce, the advantages of using robots have been realized to the point that they are becoming a part of our collective experience and everyday lives.

They often function to relieve us from danger and tedium:

Safety - Robotics have been developed to handle nuclear and radioactive chemicals for many different uses including nuclear weapons, power plants, environmental cleanup, and the processing of certain drugs.

Unpleasantness - Robots perform many tasks that are tedious and unpleasant, but necessary, such as welding or janitorial work.

Repetition and Precision - Assembly line work has been one of the mainstays of the robotics industry. Robots are used extensively in manufacturing and, more glamorously, in space exploration, where minimum maintenance requirements are emphasized.

Mechanical Platforms - The Hardware Base

A robot consists of two main parts - the robot body and some form of artificial intelligence (AI) system. Many different body parts can be called a robot. Articulated arms are used in welding and painting; gantry and conveyor systems move parts in factories; and giant robotic machines move earth deep inside mines. One of the most interesting aspects of robots in general is their behavior, which requires a form of intelligence. The simplest behavior of a robot is locomotion. Typically, wheels are used as the underlying mechanism to make a robot move from one point to the next. Of course, some motive force required to make the wheels turn under command.

Motors

A variety of electric motors provide power to robots, allowing them to move material, parts, tools, or specialized devices with various programmed motions. The efficiency rating of a motor describes how much of the electricity consumed is converted to mechanical energy. Some of the mechanical devices that are currently being used in modern robotics technology include:

DC Motor - Permanent magnet, direct-current (PMDC) motors require only two leads, and use an arrangement of fixed- and electro-magnets (stator and rotor) and switches. These form a commutator to create motion through a spinning magnetic field.

AC Motor - AC motors cycle the power at the input-leads, to continuously move the field. Given a signal, AC and DC motors perform their action to the best of their ability.

Stepper Motor - Stepper motors are like brushless DC or AC motors. They move the rotor by applying power to different magnets in the motor in sequence (stepped). Steppers are designed for fine control and will not only spin on command, but can spin at any number of steps-per-second (up to their maximum speed).

Servomotors - Servomotors are closed-loop devices. Given a signal, they adjust themselves until they match the signal. Servos are used in radio control airplanes and cars. They are simple DC motors with gearing and a feedback control system.

Driving Mechanisms

Gears and Chains - Gears and chains are mechanical platforms that provide a strong way to transmit rotary motion from one place to another, possibly changing it along the way. The speed change between two gears depends upon the number of teeth on each gear. When a powered gear goes through a full rotation, it pulls the chain by the number of teeth on that gear.

Pulleys and Belts - Pulleys and belts, two other types of mechanical platforms used in robots, work the same way as gears and chains. Pulleys are wheels with a groove around the edge, and belts are the rubber loops that fit in that groove.

Gearboxes - A gearbox operates on the same principles as the gear and chain, without the chain. Gearboxes require closer tolerances, since instead of using a large loose chain to transfer force and adjust for misalignments; the gears mesh directly with each other. Examples of gearboxes can be found on the transmission in a car, the timing mechanism in a grandfather clock, and the paper-feed of your printer.

Power Supplies

Two types of battery generally provide power supplies. Primary batteries are used once and then discarded; secondary batteries operate from a (mostly) reversible chemical reaction and can be recharged several times. Primary batteries have higher density and a lower self-discharge rate. Secondary (rechargeable) batteries have less energy than primary batteries, but can be recharged up to a thousand times depending on their chemistry and environment. There are literally hundreds of types and styles of batteries available for use in robots. Batteries are categorized by their chemistry and size, and rated by their voltage and capacity. The voltage of a battery is determined by the chemistry of the cell, and the capacity by both the chemistry and size. The robot platform runs off of two separate battery packs, which share only a ground. This way, the motor may dirty up one power source while the electronics can run off of the other. The electronics and the motors can also operate from different voltages.

Electronic Control

There are two major hardware platforms in a robot. The mechanical platform of unregulated voltages, power and back-EMF spikes, and the electronic platform of clean power and 5-volt signals. These two platforms need to be bridged in order for digital logic to control mechanical systems. The classic component for this is a bridge relay. A control signal generates a magnetic field in the relay's coil that physically closes a switch. MOSFETs, for example, are highly efficient silicon switches, available in many sizes like the transistor that can operate as a solid-state relay to control the mechanical systems. On the other hand, larger sized robots may require a PMDC motor in which the value of the MOSFET's "on" resistance Rds(on) results in great increases in the heat dissipation of the chip, thereby significantly reducing the chip's heat temperature. Junction temperatures within the MOSFET and the coefficients of conduction of the MOSFET package and heat sink are other important characteristics of PMDC motors. There are two broad families of transistor - bipolar junction transistors (BJT) and field-effect transistors (FET). In BJT devices, a small current flow at the base moderates a much larger current between the emitter and collector. In FET devices, the presence of an electrical field at the gate moderates the flow between the source and drain.

Sensors

Robots react according to a basic temporal measurement, requiring different kinds of sensors. In most systems a sense of time is built in through the circuits and programming. For this to be productive in practice, a robot has to have perceptual hardware and software, which is updated quickly. Regardless of sensor hardware or software, sensing and sensors can be thought of as interacting with external events (in other words, the outside world). The sensor measures some attribute of the world. The term transducer is often used interchangeably with sensor. A transducer is the mechanism, or element, of the sensor that transforms the energy associated with what is being measured into another form of energy. A sensor receives energy and transmits a signal to a display or computer. Sensors use transducers to change the input signal (sound, light, pressure, temperature, etc.) into an analog or digital form Capable of being used by a robot.

Logical Sensors - One powerful abstraction of a sensor is a logical sensor, which is a unit of sensing or module that supplies a particular percept. It consists of the signal processing, from the physical sensor, and the software processing needed to extract the percept.

Proprioceptive Sensors - Proprioception is dead reckoning, where the robot measures a signal originating within itself.

Proximity Sensors - A proximity sensor measures the relative distance between the sensor and objects in the environment.

Infrared (IR) Sensors - Another type of active proximity sensor is an infrared sensor.

It emits near-infrared energy and measures whether any significant amount of the IR light is returned.

Bump and Feeler Sensors Another popular class of robotic sensing is tactile, or touchbased, done with a bump and feeler sensor. Feelers or whiskers are constructed from sturdy wires. A bump sensor is usually a protruding ring around the robot consisting of two layers.

Microcontroller Systems

Microcontrollers (MCUs) are intelligent electronic devices used inside robots. They deliver functions similar to those performed by a microprocessor (central processing unit, or CPU) inside a personal computer. MCUs are slower and can address less memory than CPUs, but are designed for real-world control problems. One of the major differences between CPUs and MCUs is the number of external components needed to operate them. MCUs can often run with zero external parts, and typically need only an external crystal or oscillator. There are four basic aspects of a microcontroller - speed, size, memory, and other. Speed is designated in clock cycles, and is usually measured in millions of cycles per second (Megahertz, MHz). The use of the cycles varies in different MCUs, affecting the usable speed of the processor. Size specifies the number of bits of information the MCU can process in one step - the size of its natural cluster of information. MCUs come in 4-, 8-, 16-, and 32-bits, with 8-bit MCUs being the most common size. MCUs count most of their ROM in thousands of bytes (KB) and RAM in single bytes. Many MCUs use the Harvard architecture, in which the program is kept in one section of memory (usually the internal or external SRAM). This in turn allows the processor to access the separate memories more efficiently. The fourth aspect of microcontrollers, referred to as "other", includes features such as a dedicated input device that often (but not always) has a small LED or LCD display for output. A microcontroller also takes input from the device and controls it by sending signals to different components in the device. Also the program counter keeps track of which command is to be executed by the microcontroller.

R/C Servos - Servomotors, used in radio-controlled models (cars, planes, etc.) are useful in many kinds of smaller robots, because they are compact and quite inexpensive. The servomotors themselves have built-in motor, gearbox, position feedback mechanisms and controlling electronics. Standard radio control servomotors, which are used in, model airplanes, cars and boats are useful for making arms, legs and other mechanical appendages which move back and forth rather than rotating in circles.

Wide World Of Robots

Around the globe, robots are becoming familiar parts of our working lives. Japan is a world leader in robotics. They have 400,000 robots working in factories - 10 times as many as the United States. Robots are used in dozens of other countries. As robots become more common, and less expensive to make, they will continue to increase their numbers in the workforce. Naturally, this is a matter of concern for factory workers, who may see their positions filled by robotic systems.

Chapter 2

Overview Of Project

Block diagram of Mobile Controlled Robot –

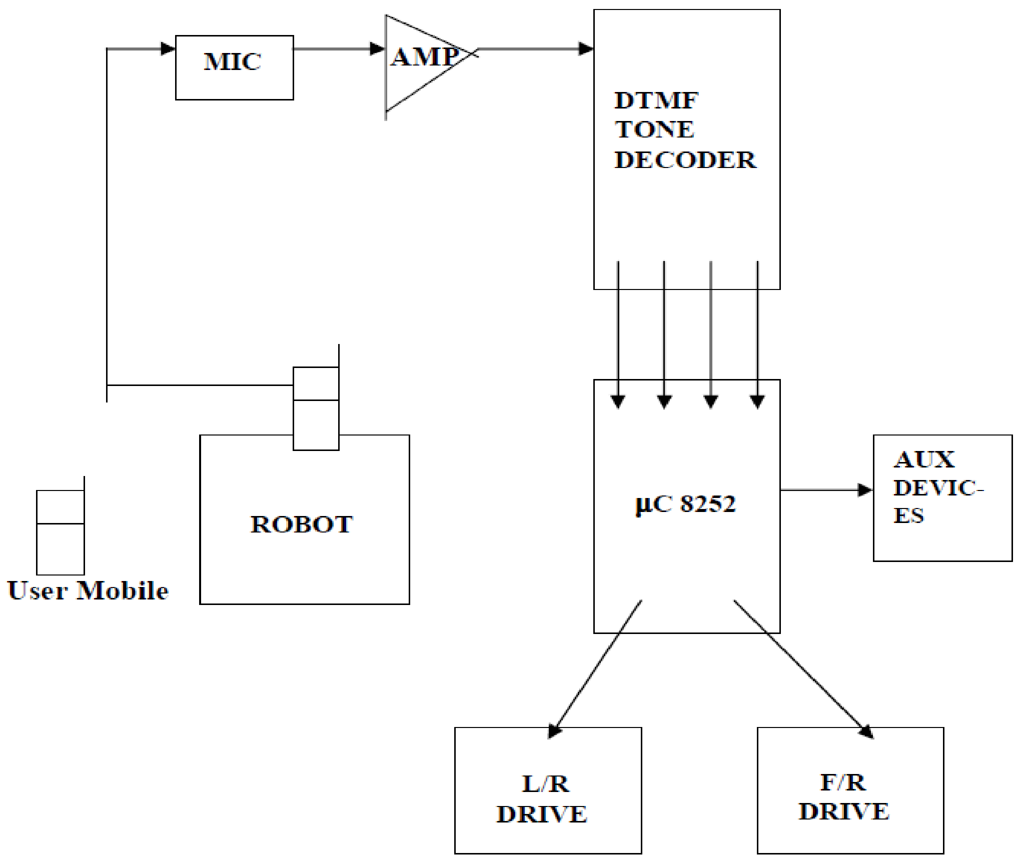
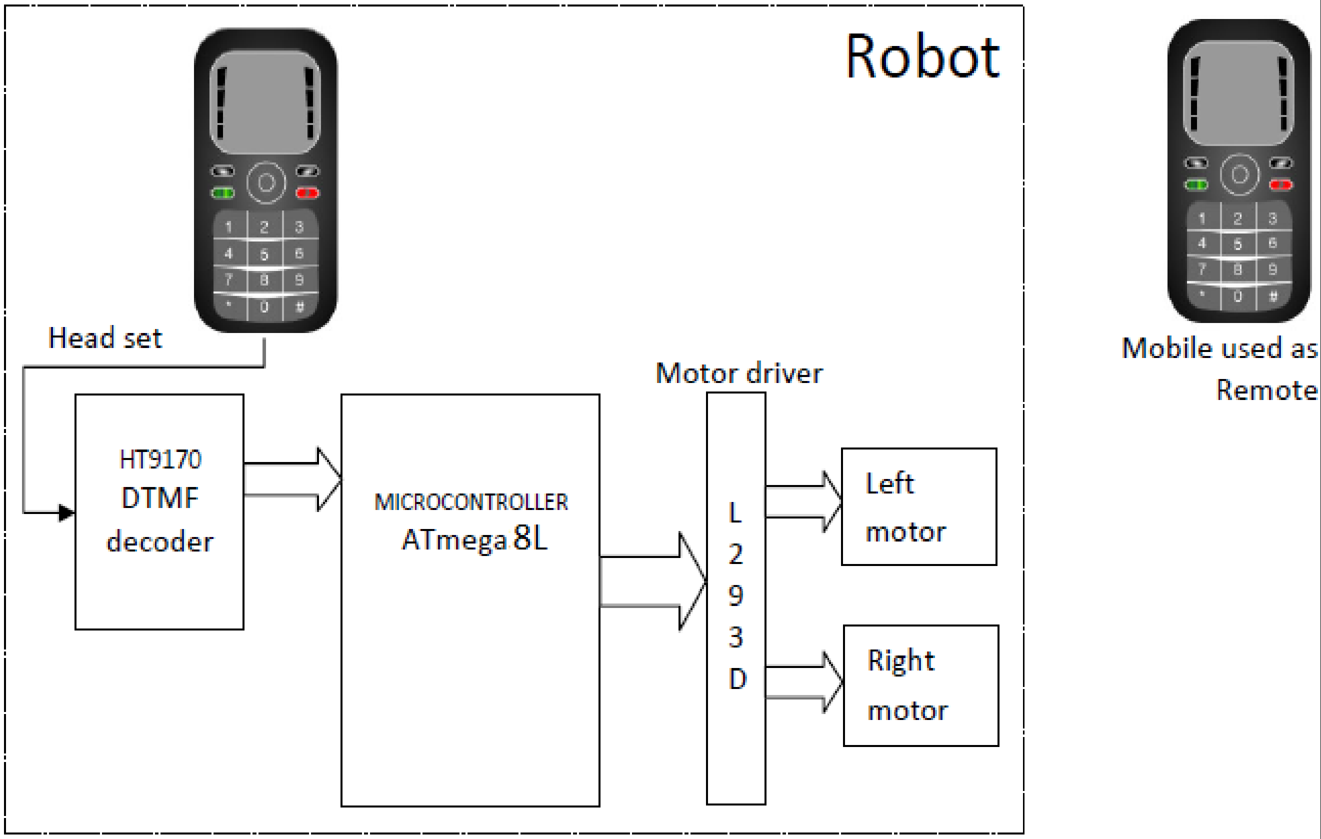


Fig 2.Basic block diagram



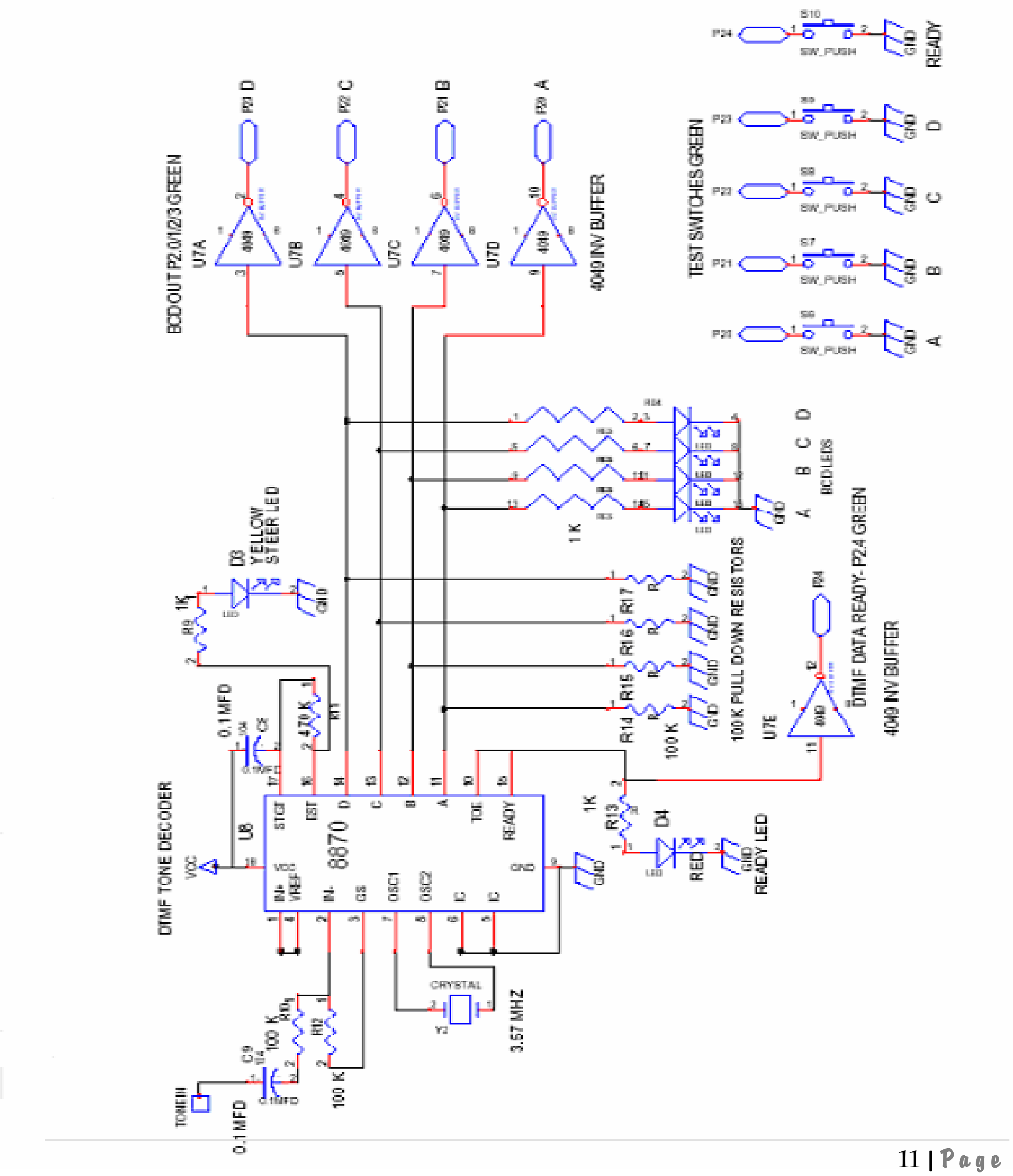
For Example:

Let key 2 be assigned for forward motion, key 4 for left, key 6 for right and key 8 for backward motion. When forward motion is required, a call is established and key 2 is pressed. The DTMF circuit picks up the frequency and determines that key 2 has been pressed. This is fed to the micro controller in the form of an 8421 code i.e. 0010. The micro controller, which has been pre-programmed, gives the signal to the motor to move forward.

Chapter 3

Schematics Of Project

DTMF CIRCUIT:



A row and column grid looks like this.

1	2	3	597hz
4	5	6	770hz
7	8	9	852hz
*	0	#	941hz
1209hz	1336hz	1477hz	

8870 – DTMF Receiver and Decoder

Features:

- Complete DTMF receiver
- Low power consumption
- Internal gain setting amplifier
- Adjustable guard time
- Central office quality
- Power down mode
- Inhibit mode
- Backward compatible with 8870C/8870C-1

Applications:

- Receiver system for British telecom
- Repeater systems/Mobile radio
- Credit card systems
- Remote control
- Personal computers
- Telephone answering machine

Description:

The 8870D/8870D-1 is a complete DTMF receiver integrating both the band split Filter and digital decoder functions. The filter section uses switched capacitor techniques for high and low group filters; the decoder uses digital counting techniques to detect and decode all 16 DTMF tone pairs into a 14 bit code. External component count is minimized by on chip provision of a